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The Consolidation of Electrical World, Electrical Engineer and American Electrician

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Wallenpaupack Hydro-Electric and 220-Kv. Transmission Development.....159

BY A. E. SILVER AND A. C. CLOUGHER

THIS issue of ELECTRICAL WORLD contains the complete story of the design and construction of the Wallenpaupack hydro-electric development and 220-kv. transmission line. The detailed information covering the three divisions into which the description naturally falls, power plant, substations and transmission line, will undoubtedly be to the interested engineer almost a handbook for similar construction. After reading the material presented herein one must agree with the opinion that Wallenpaupack is an engineering achievement to reflect much credit upon those who are responsible for its projection and accomplishment.

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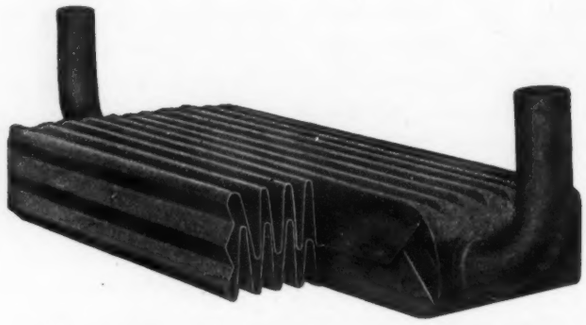
Pittsburgh Film Radiator for Self-Cooled Transformers—Single Phase and Polyphase

THE *Pittsburgh Film Radiator* is stronger and more efficient than any radiator or any other means of heat dissipation for transformers that has ever been invented. This is an invention of high rank, originated by the Pittsburgh Transformer Company engineers.

A COMPARISON of the Pittsburgh Film Radiator with ordinary steel pipes or tubes shows that the Radiator (employing the same quantity of oil) has from two to four times the radiating surface that the pipe has. (Page 3, Bulletin No. 2046, June, 1925.) This is brought about by the method of construction of the Pittsburgh Film Radiator, as shown in the photograph of the radiator with a section cut out. This construction gives large radiating surface, with a very small film of oil, this film being about ¼-in. in thickness, and the flutes of the radiator exposed on both sides to the cooling air.



Photograph of Pittsburgh Film Radiator with section cut out, showing large radiating surface with very small film of oil.

COPPER Alloy Steel is used in making the Pittsburgh Film Radiator,—this steel is from five to eight times more rust-resisting than ordinary steel,—and the construction is so simple and sturdy that the radiator is welded to the tank in our factory and the transformer shipped complete and full of oil, ready to operate, which of course will save much time for the operator in getting the transformers working.

THERE are no fragile parts in the Pittsburgh Film Radiator, and *no crevices or moisture pockets.* It is a first class mechanical job.

Pittsburgh Transformer Company

Largest Manufacturers of Transformers exclusively in the United States

Pittsburgh, Pennsylvania

Electrical World

Published by McGraw-Hill Publishing Company, Inc.
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VOLUME 88 — *New York, Saturday, July 24, 1926* — NUMBER 4

Industry Loses Leader in Death of Charles A. Coffin

WHAT Carnegie was to steel, Morgan to finance and Rockefeller to oil, Charles A. Coffin was to electricity. He, more than any one else, gave magnitude and stability to the electric light and power industry, the electric railway industry, the electrical manufacturing industry and to the distribution and utilization of electrical apparatus and household appliances, by his encouragement of research and invention, by his financial genius, by his talents for organization, by his wonderful vision and prowess in introducing and marketing electric apparatus and appliances. However, Mr. Coffin's aversion to publicity was such that outside of his circle of acquaintanceship he was little known. This is unfortunate in a leader, because a man of such great faith and power as the founder of the General Electric Company possessed might have bequeathed more than works as a legacy to the great industry which mourns his loss. Had he been less reticent, his integrity, always a force in his own organization, would have been an example to business men everywhere and his life an even greater inspiration to those in the industry he helped to create; for C. A. Coffin was one of America's masterpieces.

From friends and confidants who knew him best the ELECTRICAL WORLD has requested some words of appreciation and comment on the life of Mr. Coffin and his contribution to industry. These messages picture the man as he was and as others not blessed with his acquaintanceship will be glad to know him. It would be difficult to give a better epitome to Mr. Coffin's life and accomplishments and the lessons to be derived therefrom. His business associates tell of early struggles and victories. They show how he brought order out of chaos and how he laid the foundation for the wonderful industry which will ever be his monument. Moreover, they reveal that beneath all his greatness and power Mr. Coffin possessed an affectionate heart, a generous and appreciative nature and an attractive personality which were endearing. Possibly the consciousness that he had found a lodgment in the hearts of those about him meant more to Mr. Coffin than the plaudits of the crowd. This was his great reward, and it spurred him on to greater and greater triumphs until flesh and blood would yield no more.

Conservative Financiers Must Protect Industry

ASKED whether the purchase price of utility properties can be safely based on their possible earnings rather than on the invested capital, the executive in charge of finance of one large holding company had the following to say:

"In my opinion the earnings of utility companies must invariably bear a relation to the value of the property. Many factors have to be taken into consideration in determining what constitutes a fair rate of return and what maximum earnings are possible and permissible under the practice of the state regulations. All purchases and consolidations of utility properties should be made with full knowledge that earnings will be limited to a fair rate of return on property value and that maximum earnings are possible only as the result of good management and conservative financing."

If all adhere to this policy and companies do not bid recklessly against one another in the attempt to acquire new properties which will fill out their interconnection schemes, there will be less milking of holding companies by middlemen who are apparently acquiring and "holding out on" the sale of properties inherently essential to logical group ownerships. Of course, large holding companies may not be seriously affected by any future adjustment of earnings if they have paid more than they should for strategic additions, because the added investment may represent only a small part of the original investment before additions. However, if excessive prices have been paid for properties by the smaller holding companies, or by those which have increased their holdings considerably in the last few years, adjustment of earnings to a fair valuation may not leave much for common-stock dividends.

Anything which casts reflections on utility securities, even though they be only common stock, will react seriously on the now enviable financial standing which electric light and power companies have attained. Consequently stewardship must be exercised by the more conservative companies, and these must acquaint their customers with the principles of conservative financing.

First 220-Kw. Development in the East

THE Wallenpaupack development and the associated 220-kv. transmission line offer opportunities for interesting studies of power-station and transmission practices. The system is a unit of a type of major system toward which the light and power companies are rapidly building in many sections east of the Rocky Mountains. These systems will use 220-kv. transmission to transmit enormous blocks of energy comparatively short distances rather than to transmit small blocks of energy a long distance. Thus as a backbone structure the 220-kv. Eastern line is worthy of study.

Design characteristics of the new line are unusual and differ greatly from those found in the Pacific Coast installations. A very strong structure was necessary to withstand the ice and wind conditions found in the territory traversed, and an exposure of one inch of ice radially at lower levels and one and one-half inches of ice radially at higher elevations was chosen by the line designers. A strong structure was necessitated by the loadings chosen, and, in order to limit the stresses on

towers which would result when conductors broke or when loads were unbalanced, a special clamp was designed and used. This clamp is designed to slip at moderate values of stress in order to relieve the tower.

Another unique feature of the line is the use of guyed structures on dead-end and heavy-angle towers. These structures are pivoted at the bottom by means of a specially designed ball-and-socket joint, and all load on the structures is vertical since the side pulls are carried to suitable anchorages by guys in tension. Still another feature is the use of a soft-iron compression sleeve for splicing the steel-reinforced aluminum conductor, instead of the more frequently used twisted sleeve.

No one can say what service conditions may do to the new line, but every precaution has been taken to safeguard the system against any contingency that may occur, and the engineers responsible are confident of the success of the line. Other Eastern properties will study the results of this installation with a great deal of interest, for it was designed to meet conditions and to operate in an environment which are similar to those prevailing over a wide stretch of territory.

Central-Station Revenue from Residence Lighting

LIGHTING as a source of revenue for central-station companies is not only rapidly increasing but it is still forging ahead faster than the rest of the revenue fields for electrical energy. In 1921 revenue from lighting was 60 per cent of the total revenue from the sale of electrical energy. This percentage steadily increased until in 1925 revenue from lighting was 67 per cent of the total. However, only about one-fourth of the total electrical energy generated in 1925 was consumed in lighting.

Of the total revenue collected in 1925 from electric lighting, 41 per cent was contributed by residential lighting. Of the total electrical energy generated last year, 9 per cent was consumed in the residential field, but this 9 per cent represented 28 per cent of the total revenue received for the sale of electrical energy for all purposes. By raising the standard of residence lighting to one of convenience and adequacy from a utilitarian viewpoint, this 28 per cent could without difficulty be increased to at least 40 per cent and even to 50 per cent.

With about 14,500,000 residential customers on the lines at the beginning of 1926, with each of these now consuming about 370 kw.-hr., with the possibilities of greatly increasing the energy consumption of the average residential customer, and with the addition of a million or more residential customers per year to the central-station lines, there become apparent in the residential field enormous revenue and opportunity. From a rather low status only a few years ago the residential field has risen to the position of highest favor. There is indeed a pot of gold at the end of the residential rainbow. The flow of revenue from residences will increase more or less without special effort, for the field grew very largely without much guidance and salesmanship as compared with most commercial enterprises. But it has been amply proved that salesmanship can greatly increase the flow of revenue from the residential field. It is now glittering with greater promise than ever before. Its development is a commercial task worthy of the best effort.

Fishing and Power Interests Settle Their Problems

AMICABLE settlement of the conflict between fishery and power interests concerning the building of dams in salmon streams of the Pacific Northwest has come about through an installation of a fish ladder and traps at the Baker River dam in Washington. This outcome means that certain contemplated power developments in the Northwest may now go on unhampered.

Prior to this time it was thought to be established that salmon would not negotiate a ladder where the difference in elevation was more than a certain figure—put at 49 feet. This belief, however, has been proved to be a myth by the installation at Baker River, where salmon have been taken over a 260-ft. dam, and it is now believed that it is possible to transport fish over a dam several hundred feet in height, provided that the steps in the ladder are of minimum size (approximately two feet) and that the fish obtain an opportunity to rest on the way up. An essential factor in making this possible is a series of traps which prevent the fish from turning back once they have started.

The significance of what has been accomplished in Washington may be seen from the fact that because there was no satisfactorily demonstrated method of getting salmon over high dams the people of California two years ago passed legislation withdrawing the major portion of the Klamath River from power development for all time. Such legislation need never have been passed. There never existed in the minds of utility engineers any doubt as to their ability to solve the problem if they had a reasonable chance and the co-operation of the fishery interests. The success of the Baker River installation is a fine tribute to the intelligence and public spirit of the national and state fish authorities, the utility's engineers and the joint committee which has worked diligently on the problem for more than two years. It means that the fishing industry and the light and power industry may live side by side on the same stream in the future without conflict.

Residential Substation Locations

UTILITY substations in residential districts are constantly growing in numbers as loads develop. Good-looking construction is very important in such installations because of its public relations value, but opinions differ as to the best location for many of these. Each case must be solved on its own merits, but recent experience demonstrates the desirability of weighing carefully the semi-retired location's advantages against the front-lot installation. This applies to both indoor and outdoor substations.

With the advance of supervisory control the importance of a location yielding an abundance of natural light and free ventilation for the comfort of operators has greatly diminished. One company recently found that a back-lot location will relieve it from betterment assessments on the adjacent street; less expense for architectural effect was another by-product of putting

the installation far enough from the main thoroughfare to enable the company to sell the intervening lot if desirable, and at the same time a well-designed building to house switch cells, buses and instruments for the moderate voltage work in hand was easily obtained. The temptation is often considerable to put a substation which, in appearance, is a cross between a small public library and a sarcophagus on a fine grass plot facing a traveled avenue, but with underground conduit construction very good-looking utilitarian structures can be built a little behind the scenes and money saved. Compactness without sacrifice of operating convenience can be had at the cost of an unbiased study, and the installation of relays and watt-hour meters on panels above the interior switch cells instead of on floor framing is working out well in later practice.

In many cities business establishments are gradually locating in neighborhoods formerly known as "bated breath" districts; residential loads are growing fast, and expansion of facilities makes substation location a live problem. Granted that many tastefully ornamental and some structurally beautiful substations may be warranted despite their first cost, the pros and cons of a "back-stage" location may well be considered by utility engineers responsible for the location and design of these items in utility property.

Rural Rates and the Mad Hatter's Tea Party

ALICE could make absolutely nothing out of the Dormouse's story, and the explanatory comments of the March Hare served only to add to her mental confusion. Nor did the remarks contributed by the Mad Hatter do anything but increase the befuddlement of her befuddled brain. It certainly appeared to the poor girl that both the Hare and the Hatter were convinced themselves that they knew what they were talking about, but somehow she could not share that conviction.

"In talking to the farmers regarding this [rural] plan we do not emphasize the service charge, because it is something which they do not understand readily."

"The chief duty of the rural department is to sell to the farmers not only the idea of rural electrification but also the idea of analyzing rural costs."

The foregoing remarks are quoted from published executive opinions on the subject of rural service. The Dormouse's story is to be found elsewhere in this issue of the ELECTRICAL WORLD. The Dormouse who tells this story is, however, much more wide awake than the one that tortured Alice. But that does not make his story any easier to understand. On the contrary, one might almost swear that Lewis Carroll never could do by imagination what is here done by factual analysis.

Since Carroll is dead and gone, there is now no one to say whether or not there is any meaning under the Dormouse's story about the little girls who lived in a well. One can appreciate the vast amount of painstaking labor which went into the formulation of the rural rate here adverted to, but when that rate expresses itself in mystic formulas and devious calculations one cannot blame our Alice—the farmer—for not understanding its meaning—to put it mildly.

All of which leads up to the cue for one to say calmly, but none the less forthrightly, that all of the study and calculation—of which there cannot be too much—that go to make up the structure of a rural rate should result in an easily understandable and brief statement of what the farmer will owe to the utility for the service he will receive.

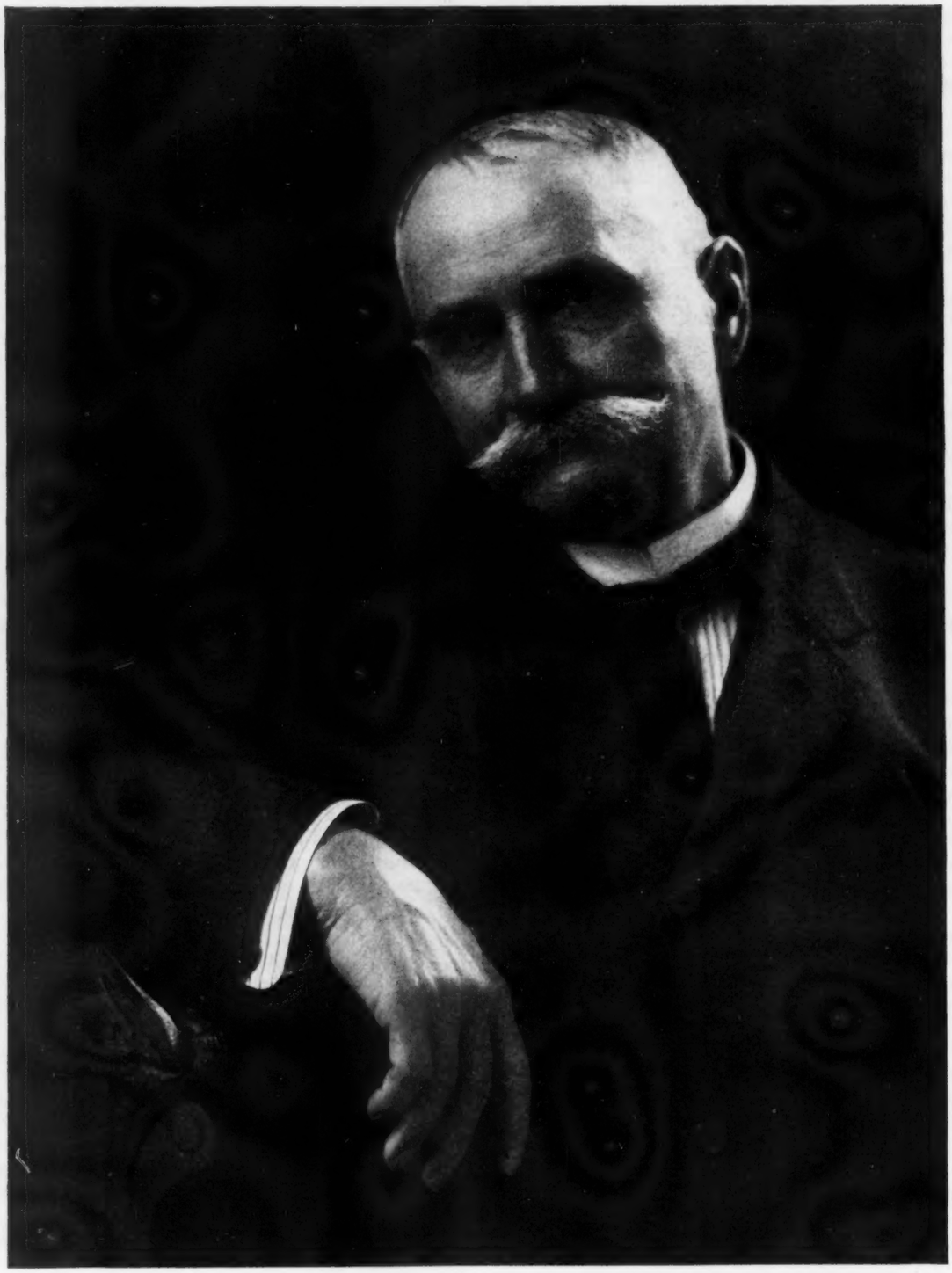
Too Much Criticism of Central-Station Commercial Men

FOR the past two years a veritable barrage of criticism has been laid down against central-station commercial departments, their management, personnel and practices. Vociferous well wishers both in and out of the utility business have volunteered indictments against the power companies' commercial men collectively and individually, charging a wide variety of ills ranging from hookworm and stagnation to incompetency and arrogance. The latest and probably the most insidious piece of propaganda yet conceived is that power companies should attract sales executives from other lines of business. It is alleged that the present commercial incumbents have been tried and found wanting, so they must be replaced!

Just why all this systematic belittling of the new-business man's ability and accomplishment? Is it possible that there are forces at work that might find it advantageous to set up an inferiority complex in the minds of commercial men so that they will be more susceptible to the blandishments of other interests with an axe to grind? Have outside interests men whom they would prefer to see in charge of central-station commercial affairs? Is there any good reason at this time for swapping horses in the middle of the stream? Or is it an honest desire to help which has been misdirected into a form of destructive criticism? Let it be hoped that it is the latter and that no utility executive will uproot his existing new-business organization and supplant it with outside talent until the shortcomings of the present régime have been conclusively demonstrated.

Before entering upon any program which calls for a radical change in the type of commercial personnel, utility executives should consider carefully what the effect would be. The importation of high-powered sales staffs, expert in getting customers' dollars but unfamiliar with the industry's traditions, would present a monumental problem of internal training and education. It would take it a long time to get under way.

As a matter of fact, the new-business departments haven't done such a bad job after all. They have had their troubles—plenty of them. It is only within the last year or eighteen months that systematic studies of the volume and kinds of available business have been made, and it is only within the last few months that there have been unanimous agreement and accord between executives and commercial men that greater weight must be given to the business of load building. Commercial men now have their work cut out for them and deserve a chance to produce the necessary methods, machinery and results. Commercial fault-finding as a popular pastime should have about run its course. The critic without specific plan or suggestion for improvement is a barnacle on the bottom of the ship, and the cry for new blood is unnecessary and unwelcome.



Charles Albert Coffin

Born December 30, 1844—*Died July* 14, 1926

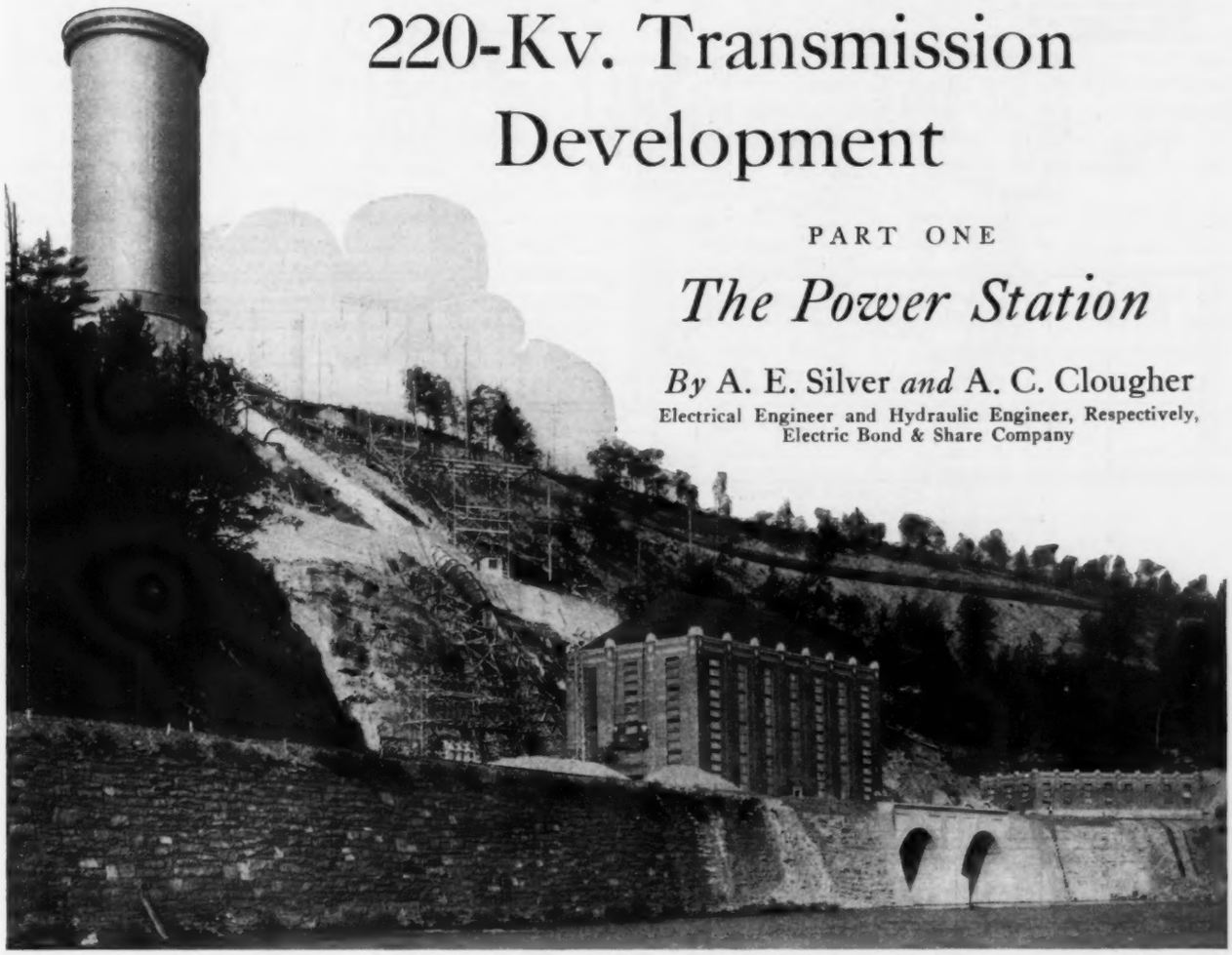
One of the guiding geniuses of the electrical industry and founder of the General Electric Company, of which he was the inspiration and the leader for 30 years.

Wallenpaupack Hydro-Electric *and* 220-Kv. Transmission Development

PART ONE

The Power Station

By A. E. Silver *and* A. C. Clougher
Electrical Engineer and Hydraulic Engineer, Respectively,
Electric Bond & Share Company



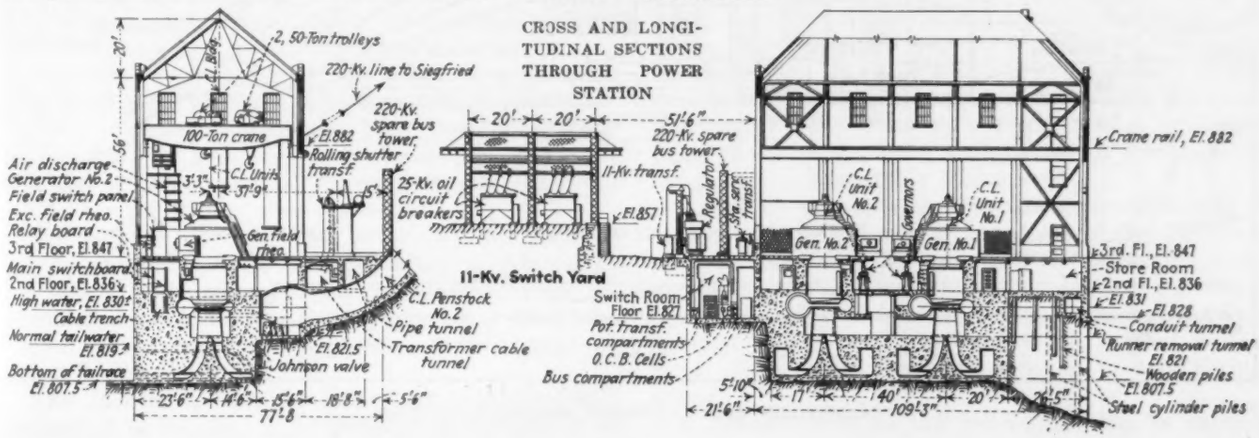
WALLENPAUPACK GENERATING STATION AND ADJACENT STRUCTURES

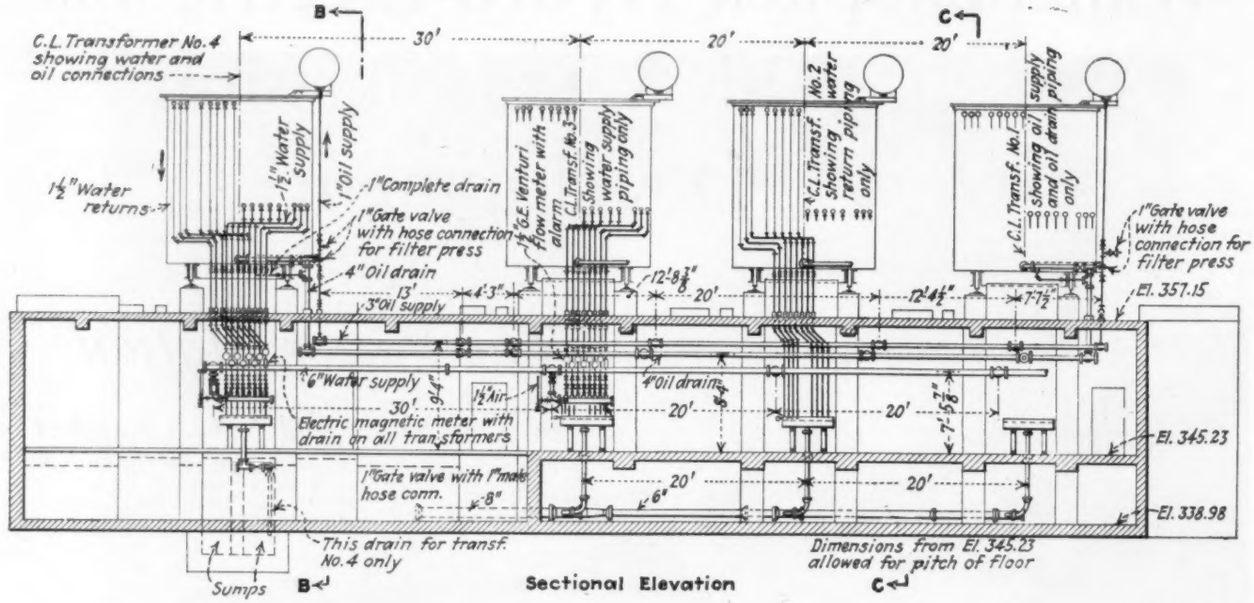
THE Pennsylvania Power & Light Company has recently completed a 40,000-kw. hydro-electric development in northeastern Pennsylvania with 65 miles of 220-kv. transmission line extending south from the power station to a step-down station in the vicinity of Allentown. The engineering for this development was done by the Electric Bond & Share Company and construction by the Phœnix Utility Company.

The stored waters of Wallenpaupack Creek are delivered through a flow line three and a half miles long to the power house on the Lackawaxen River, where are installed two vertical shaft units of 20,000 kw. each operating under a net head of 330 ft.

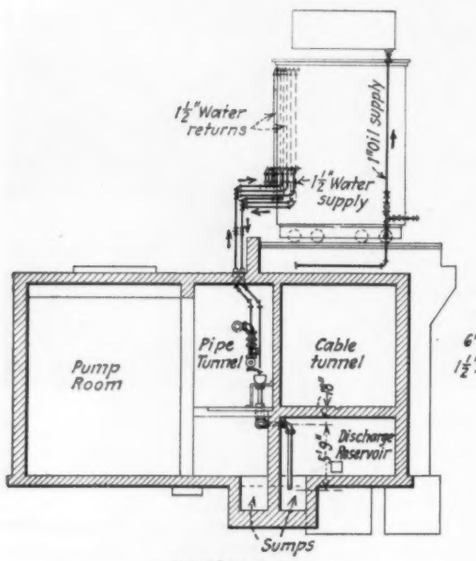
The development includes a large storage reservoir of ample capacity to regulate the stream throughout the year and to enable the plant to be used to carry weekly, monthly and even yearly peaks, consequently increasing the load factor on the steam plants that carry the base of the company's load. The present installation is so designed that it may be increased if found desirable to utilize the development at a lower load factor.

CROSS AND LONGITUDINAL SECTIONS THROUGH POWER STATION

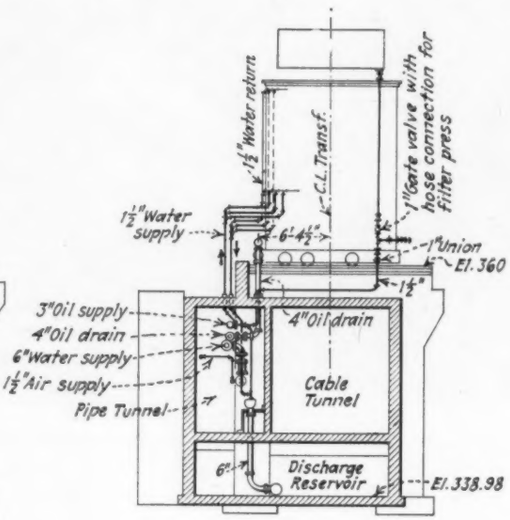



C.L. Transformer No. 4 showing water and oil connections
B
C
30'
20'
20'
1½" Water returns
1½" Water supply
1" Oil supply
1" Complete drain
1" Gate valve with hose connection for filter press
4" Oil drain
3" Oil supply
6" Water supply
1½" Air
Electric magnetic meter with drain on all transformers
1" Gate valve with ¾" male hose conn.
This drain for transf. No. 4 only
Sumps
6" E. Venturi flow meter with alarm
C.L. Transf. No. 3 showing water supply piping only
C.L. Transf. No. 2 showing water return piping only
C.L. Transf. No. 1 showing oil supply and oil drain only
1" Gate valve with hose connection for filter press
El. 357.15
El. 345.23
El. 338.98
Dimensions from El. 345.23 allowed for pitch of floor

Sectional Elevation

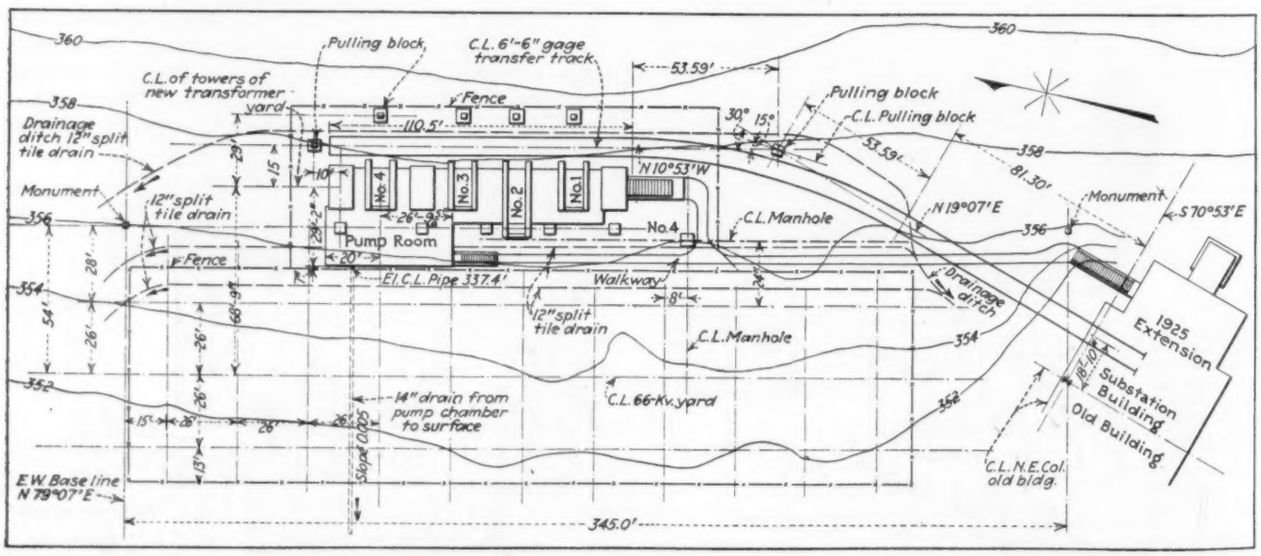


Section B-B



Section C-C

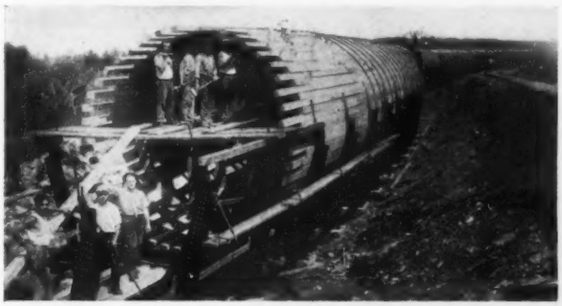
SECTIONS THROUGH TRANSFORMER CABLE AND PIPE TUNNEL, ALSO DISCHARGE RESERVOIR



TRANSFORMER YARD AND TRACK ARRANGEMENT PLAN

Two dams create the reservoir—Wallenpaupack Dam, mainly a concrete gravity structure across the channel of Wallenpaupack Creek one and a half miles west of Hawley with a heavy earth fill on the north end, and Tafton Dike, an earth dam across a depression in the reservoir margin.

The spillway on the dam is equipped with two plate steel gates of the cylindrical roller type. Only a few installations of this type of gate have been made in this country, although more than a hundred have been made in Europe during the past 25 years. The gates roll up an incline of 20 deg. with the vertical and are raised by a chain, which is wrapped around one end of each cylinder. The hoists are motor-driven, but they are so arranged that the gates can be raised by hand.



ABOVE, THE 14-FT. WOOD-STAVE FLOW LINE DURING CONSTRUCTION

IN CENTER, THE COMPLETED FLOW LINE

The wood-stave flow line is one of the largest in the country. For staves 4½x6-in. Douglas fir sticks were purchased in the rough and transported, without drying, to the site, where they were stacked and air dried for six months previous to milling and erection. A woodworking plant was built beside the pipe line and used for milling the staves, which were then erected in the pipe within 24 hours after milling. This method provided cheaper handling of the staves during transportation of the lumber, its condition was better by reason of the air drying and an entire lack of damaged, checked or warped staves resulted on account of erection immediately after milling.

The component parts of the pipe were purchased and erected by the construction organization.

The pipe is supported entirely above the ground on structural steel saddles set on two concrete pedestals. Concrete saddles, which have been used successfully under pipes of this size, were considered, but were found to be more costly and to require a greater amount of field work during pipe erection.

Six different steel saddles, weighing from 1,070 to 1,700 lb., were constructed and tested to destruction by means of jacks applied so as to approximate the forces that would be exerted by a pipe being filled with water. As a result of these tests a saddle weighing 1,590 lb. was adopted.

The Johnson differential surge tank is unusual only in respect to its size. It is probably the largest of its type ever constructed, being 55 ft. in diameter and 135 ft. high. Due to the fact that the plant may be shut down for several days at a time, owing to lack of peak loads, especially during holiday seasons, the tank has been protected against freezing by a double-layer wood sheathing with building paper between. Arrangements have been made for heating the air space between the tank and the sheathing if experience proves this necessary.

The penstocks between the surge tank and the station are of steel and will be sheathed as is the surge tank. Each penstock has been designed in such a way as to provide a Venturi meter for measuring the water for each unit, and flow meters have been installed with provisions for indicating, recording and integrating the flow.

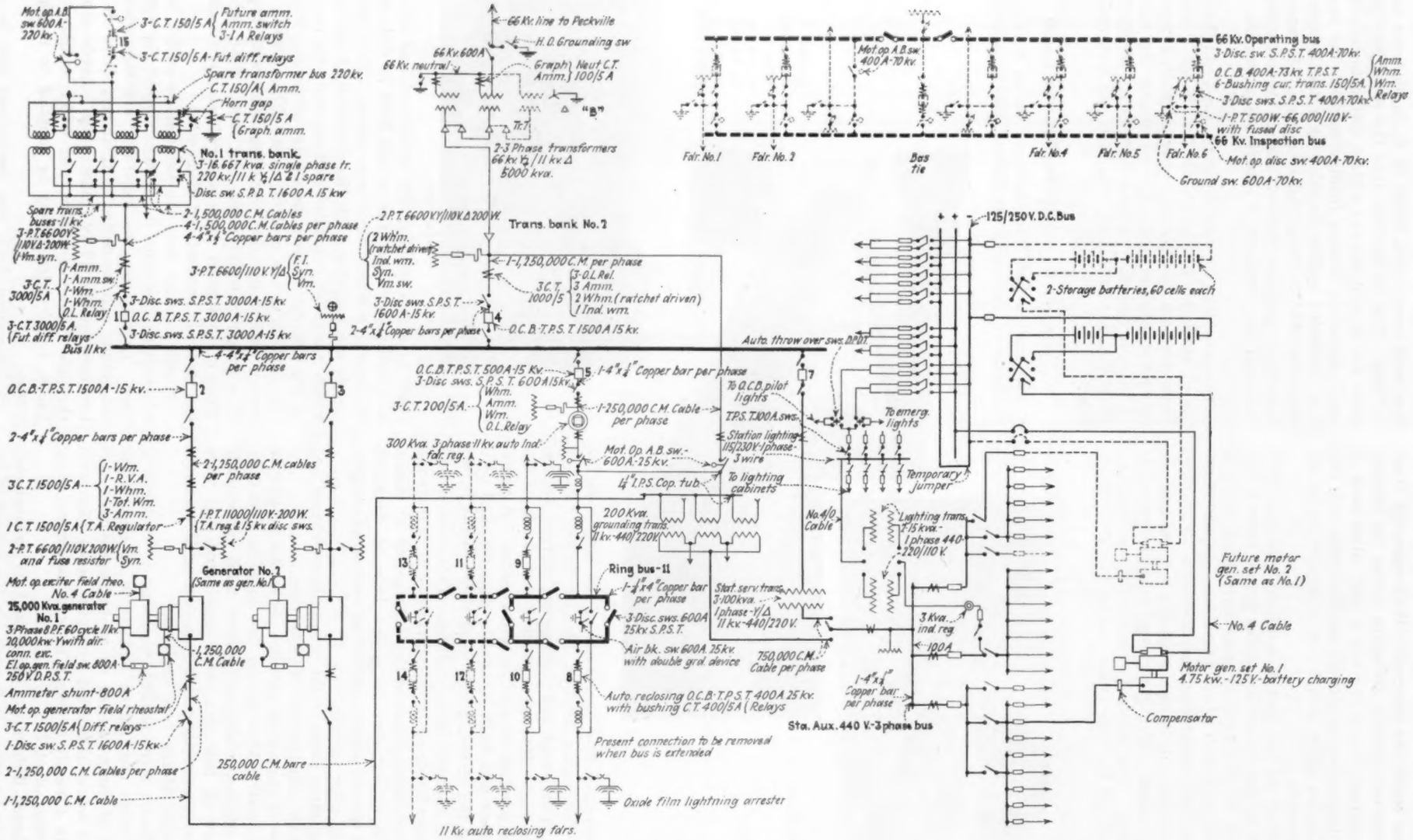
STATION DESIGNED FOR MINIMUM LABOR

The station has been laid out so as to require a minimum of operating attendance, and an attempt was made to group all auxiliary equipment and all control and indicating apparatus on one floor in plain view of the operator and within easy access. This was completely accomplished with the exception of the exciters, which are direct connected and are mounted on the top of the generators, and the exciter rheostats, which are operated from the control room. This results in the second floor being the operating floor, with the third floor purely a maintenance and repair floor, where all types of equipment from waterwheels to transformers can be easily handled and dismantled.

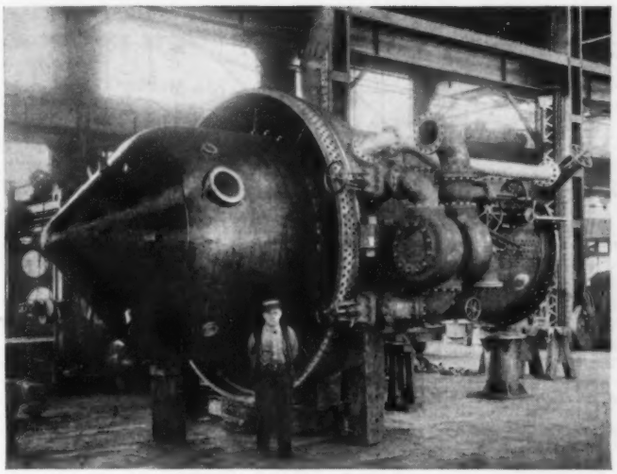
BELOW, PEDESTALS AND SADDLES TO CARRY THE FLOW LINE

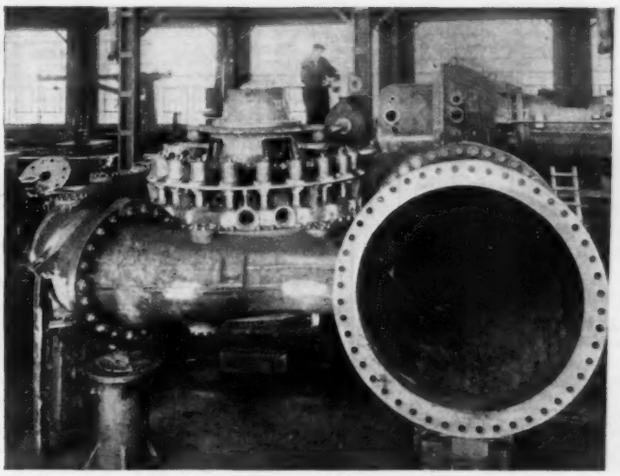
It will be seen that the low-voltage switch room is adjacent to the units in an extension of the substructure. Leads from the generator are supported from the ceiling and connected to their respective oil circuit breakers on the 11-kv. indoor bus. Leads are taken through conduit to 11-kv. and 66-kv. outdoor switch yards, from which power is supplied to neighboring towns.

A connection from the low-voltage bus is carried


66 Kv. Operating bus
66 Kv. Inspection bus
Trans. bank No. 2
No. 1 trans. bank.
Generator No. 2
25,000 Kva. generator No. 1
Ring bus-11
Sta. Aux. 440 V.-3 phase bus
125/250 V. D.C. Bus
2-Storage batteries, 60 cells each
Future motor gen. set No. 2 (Same as No. 1)
Motor gen. set No. 1 4.75 kw.-125 V.-battery charging
Compensator
Temporary jumper
Auto. throw over sws. DPDT
Present connection to be removed when bus is extended
11 Kv. auto. reclosing fdrs.
Oxide film lightning arrester

One-Line Wiring Diagram of Electrical Equipment





AT LEFT, THE 8-FT. 9-IN. JOHNSON VALVE. AT RIGHT, THE STEEL VOLUTE CASING FOR THE 28,500-HP. TURBINE

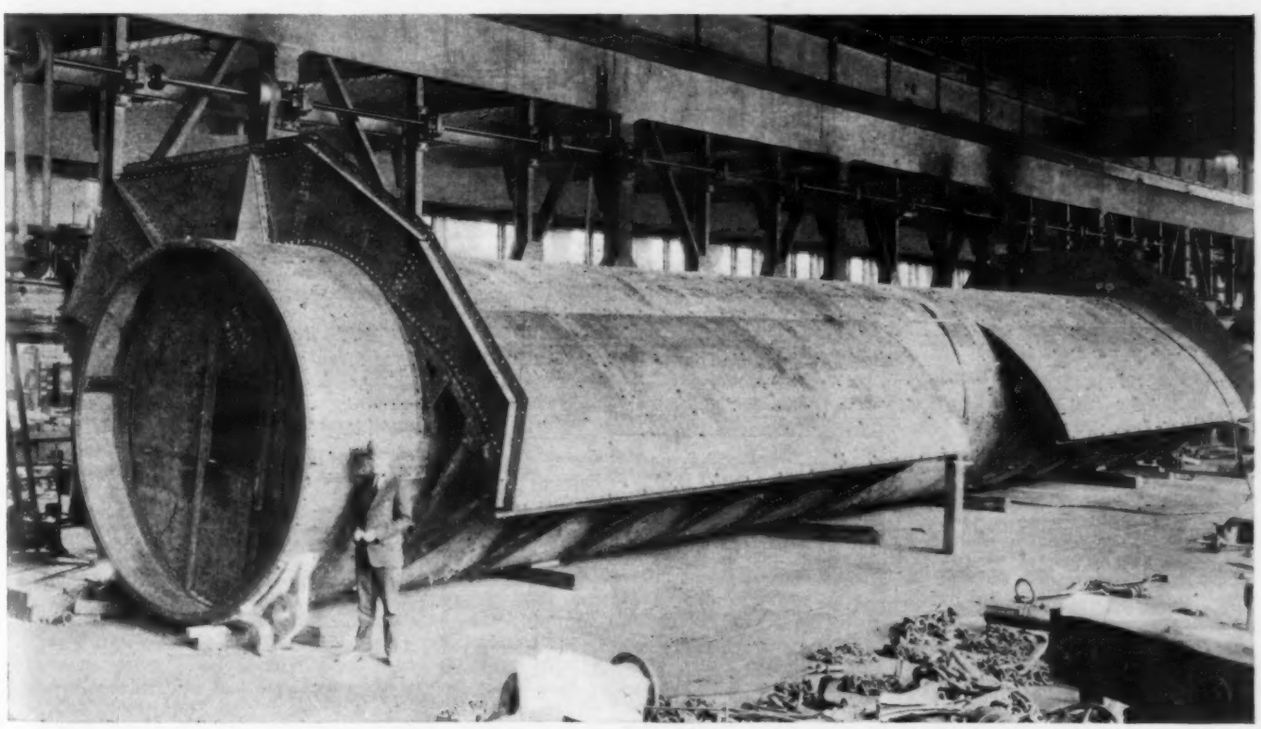
through a cable tunnel located under a bank of four single-phase, 220-kv. transformers. Three of these are for normal operation; the fourth is a spare. By operating double-throw, single-pole disconnecting switches in the 11-kv. leads located in the cable tunnel and jumpers in the 220-kv. leads any transformer can be disconnected and the spare transformer switched in.

Besides being arranged for operation in the usual manner, the turbines are provided with additional features that will permit starting them up quickly either from rest or from operation as synchronous condensers. In addition to the usual hand or motor control for opening the Johnson valves, they may be opened quickly by means of a solenoid-operated valve in the piping of the Johnson valve. The operation of this solenoid valve will cause the Johnson valve to open about half way in four seconds. The valve will continue to open at this rate until nearly fully opened. At the end of four seconds, however, enough water will pass to carry approximately the full load of the units. One-half second after the Johnson valve begins to open a contact will be made that will cause the turbine to be put on governor control and will start opening the turbine gates, bringing the unit up to no load speed. The unit can therefore be made ready for synchronizing with the line and loading up in a very short time. The solenoid valve may be actuated either by a push-button station on the switchboard or automatically, due to a maintained drop in the frequency of the interconnected system.

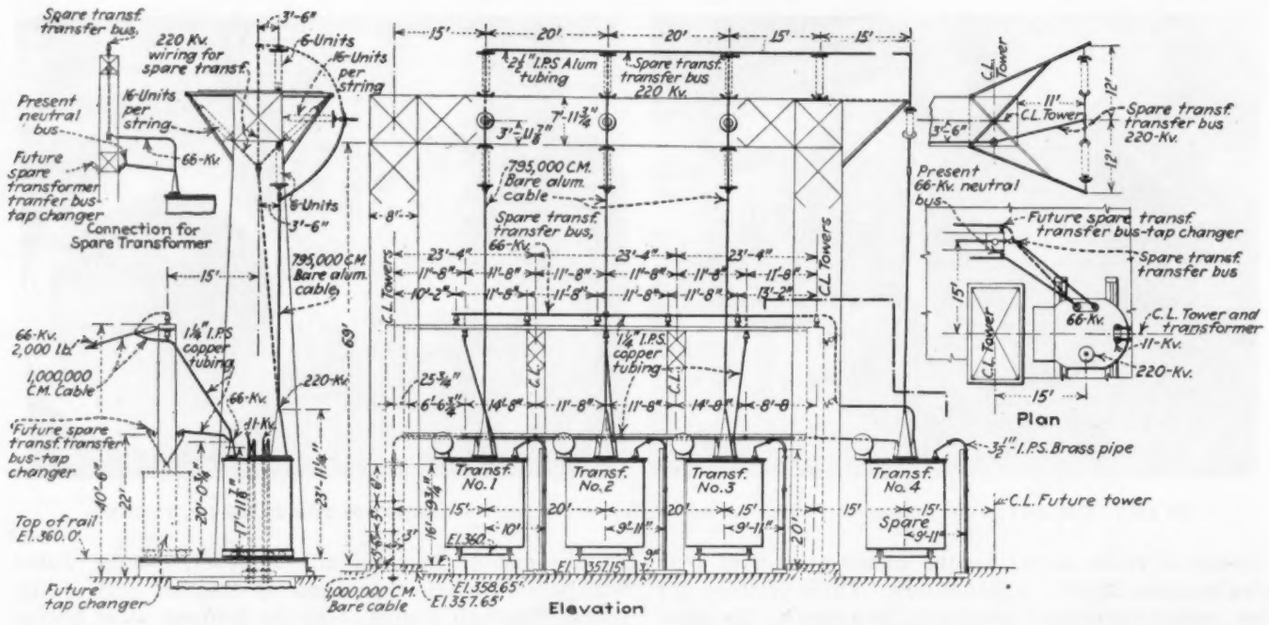
CONSTRUCTION FEATURES OF THE DEVELOPMENT

Material for the earth embankment for Wallenpaupack Dam and for Tafton Dike was secured from borrow pits near the structures.

Gravel from a hill near the dam provided excellent



A 67-FT. 6-IN. X 14-FT. ROLLER GATE



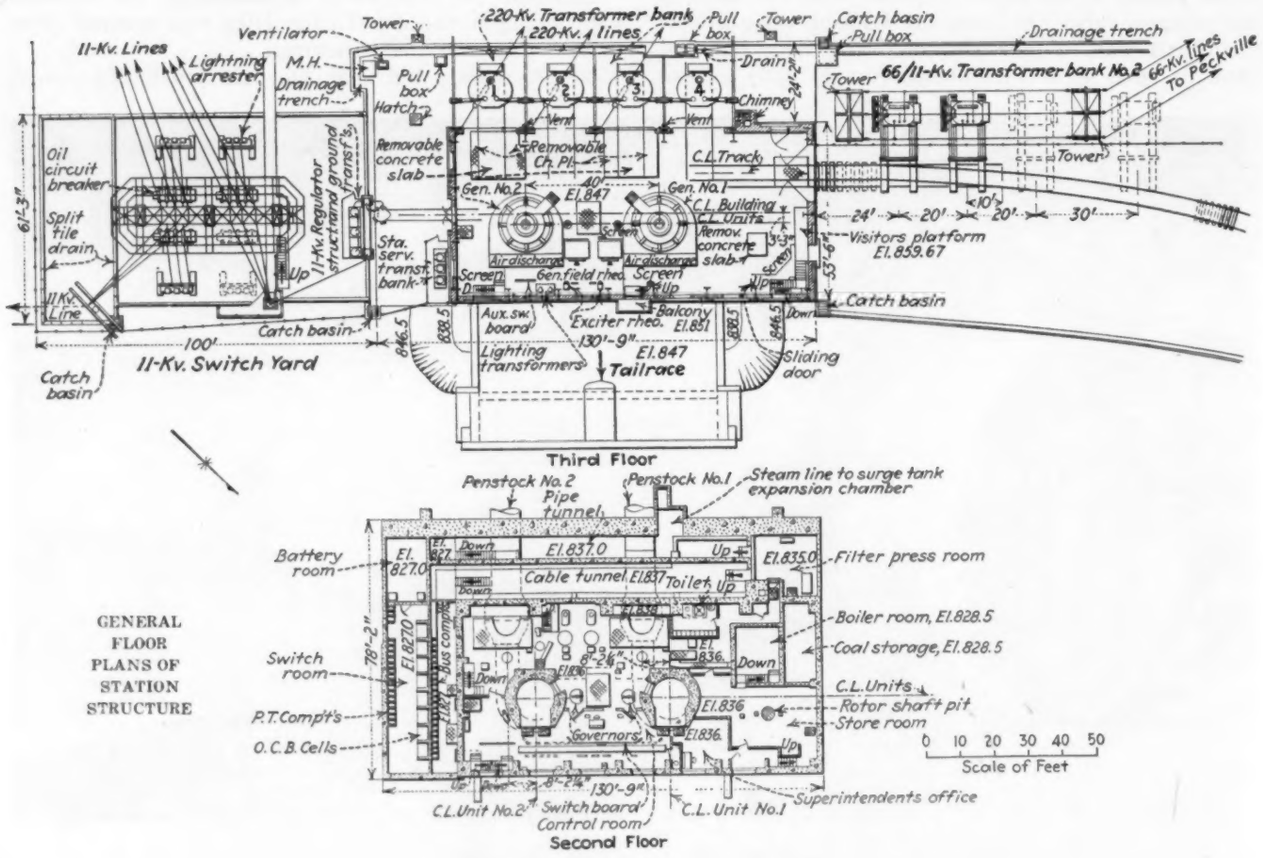
BANK OF 86,600-KVA. 220/66/11-KV. TRANSFORMERS, 220 AND 66-KV. CONNECTIONS, SPARE SINGLE-PHASE UNITS, AND PROVISION FOR TAP-CHANGING UNDER LOAD

aggregate for all of the concrete for the job, after being washed, screened and reassembled.

A standard-gage construction railroad was built from the Honesdale branch of the Erie Railroad at the generating station to the dam. This railroad paralleled the flow line and was used for placing all the materials in the pipe and its foundation.

There were no unusual problems in the construction of the development, but it was necessary to construct the tailrace bridge without interfering with traffic on the Erie Railroad, this traffic being extremely heavy, as it is a direct route from the anthracite coal regions to New York.

Actual construction work was started about May 1, 1924, and the units were first put on the line June 3, 1926.



GENERAL FLOOR PLANS OF STATION STRUCTURE

The principal characteristics of the development are shown here briefly, supplemented by illustrations.

DETAIL DATA ON THE DEVELOPMENT

Lake Wallenpaupack.—Drainage area, 229 square miles; average length, 13 miles; width, approximately 1 mile. Area at elevation 1,190 (reservoir full), 5,760 acres. Capacity down to elevation 1,160, 170,000 acre-ft., 45,000,000 kw.-hr. Highways relocated, 16 miles.

Clearing of basin: Completely cleared down to elevation 1,175. Trees cleared over entire area.

Wallenpaupack Dam.—Concrete and earth structure 1,280 ft. long; maximum height, 70 ft.; concrete, 28,000 cu.yd.; earth fill, 53,000 cu.yd.; paving 2 ft. thick, 4,700 sq.yd.

Spillway: 135 ft. long (net) for discharge depth of 14 ft. Equipped with two electrically operated cylindrical roller gates each 67.5 ft. long by 14 ft. high, manufactured by S. Morgan Smith Company. Compressed air provided to prevent ice formation against gates. Foundation under dam drilled, grouted and permanently drained.

Intake: Size, 52 ft. by 54 ft. by 62 ft. high; built of structural steel incased in concrete.

Screens: Gross area, 3,080 sq.ft.; also wood panels 1,540 sq.ft. Designed to control 3,600 sec.-ft. Steel stiff leg derrick for handling and raking. Compressed air provided for removing trash.

Gate: Structural steel, 16 ft. by 20 ft., weighted with concrete sufficiently to close against full hydrostatic pressure without aid of hoist. Weight, 240,000 lb. Electrically operated by twin-screw stem gate hoist manufactured by Coffin Valve Company; lifting capacity of two stems, 230,000 lb.

Provision made for discharging into two 14-ft. flow lines; one now bulkheaded.

Tafton Dike.—Length, 1,300 ft.; maximum height, 26 ft. Earth fill, 81,000 cu.yd.; paving 2 ft. thick, 8,470 sq.yd.

Wood-Stave Flow Line.—Extends from intake to surge tank. Length, 18,100 ft. (3½ miles). Diameter, 14 ft. inside. Head, 43 to 150 ft. Grade uniform at 3.75 ft. per 1,000 ft. Capacity (nominal), 1,700 sec.-ft. Radius of curves, minimum, 573 ft. (10 deg.). Foundations, two concrete piers per saddle. Steel saddles, number, 2,259; weight, each, 1,590 lb.; 8 ft. center to center. Staves, Douglas fir; stock 4½x6 in.; finished 4 in. net thickness; 100 to a circumference; 4,650,000 f.b.m. lumber. Bands, ⅞-in. and 1-in. diameter steel; spacing 4¼ in. to 2⅛ in.; total weight, 4,400 tons. Shoes, 146,000; weight, 714,000 lb. Galvanized steel tongues, 105,000. Pipe sprayed with two coats of anthracene oil. Bands and shoes dipped in coal-tar paint. Saddles painted with red lead, graphite and coal-tar paint. Backfilling, none.

Surge Tank.—Johnson differential type; capacity, 2,400,000 gal. Height, 135 ft.; diameter, 55 ft. Riser, 11 ft. diameter. Side plates, ⅜ to 1⅛ in. thick. Regulation: Will handle surge for full capacity of station on or off. Protection against freezing by double layer 1-in. sheathing with building paper between. Radiators around base of tank inside of sheathing; steam line from station.

Penstocks.—Two plate steel penstocks each 414 ft. long and 8 ft. 9 in. diameter (nominal). Head, including pressure rise, 150 to 414 ft. Thickness: ⅜ to ¾ in. Joints, double, triple, quadruple and quintuple riveted, double butts. Venturi meter provided in each penstock; flow indicated, recorded and integrated by instruments in powerhouse. Penstocks protected against freezing by sheathing.

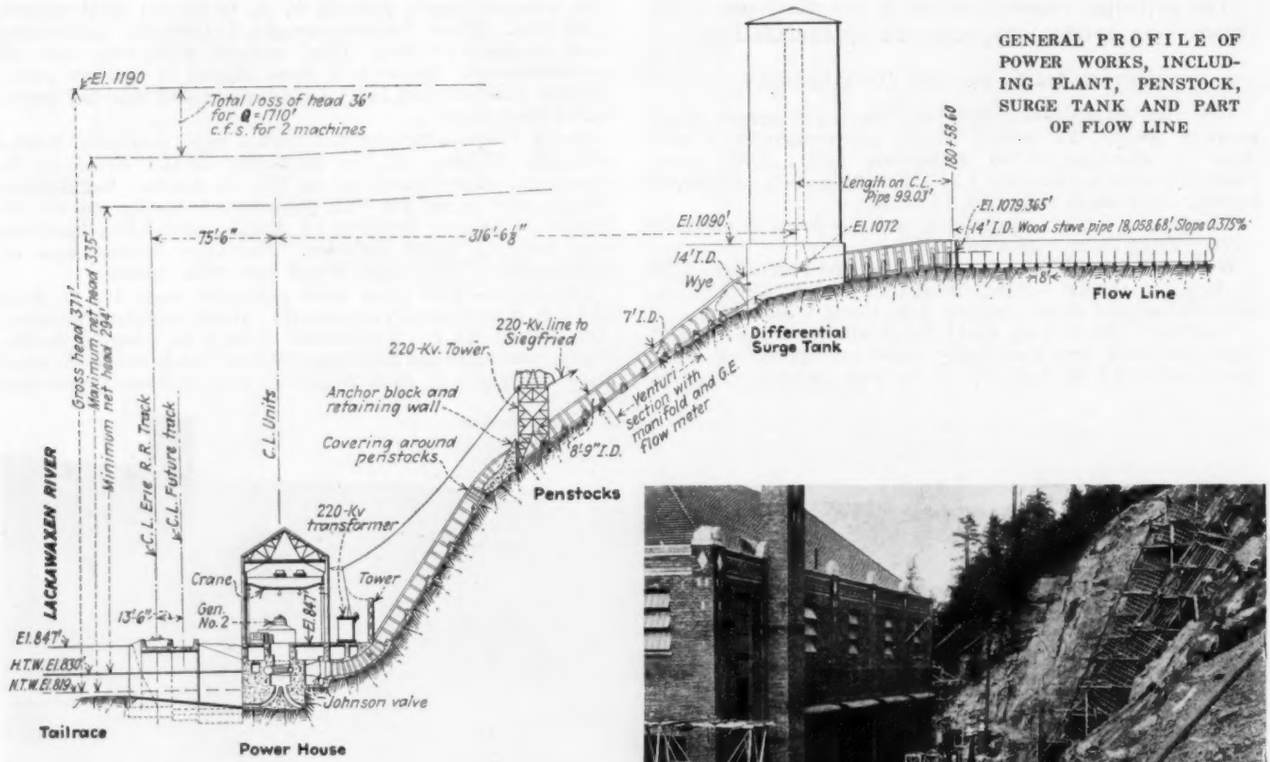
OPERATORS' VILLAGE AND WALLENPAUPACK STATION

Wallenpaupack Hydro-Electric Station.—Located on Lackawaxen River adjacent to Erie Railroad. Substructure built on ledge rock except one corner, which is supported on steel-concrete piles to rock; 130 ft. long, 75 ft. wide, 6,100 yd. concrete. Superstructure, structural steel frame, 230 tons; brick, 330,000 in walls; tile roof; top pivoted sash; 110 ft. long, 53 ft. wide, 35 ft. to crane rail; volume, 160,000 cu.ft. Crane: Capacity, 100 tons, two trolleys; auxiliary hoist, 10 tons.

Turbines.—Two I. P. Morris, vertical, reaction; rated at 28,500 hp. each; 330 ft. head, 300 r.p.m.; cast-steel scroll case; bronze runners; one guide bearing, oil lubricated. Shaft for turbine and generator in one piece 39 ft. long. Governors, actuator type, Pelton design, 54,000 ft.-lb. capacity; belt driven; designed to make full stroke in four seconds.

Johnson valves.—Each 105-in. inlet, 84-in. outlet; located close to turbines; type "B" with type "T" hydraulic control; operation by means of hand wheel, motor or solenoid valve; can be operated in valve chamber, from station switchboard or automatically. Valve position indicated in valve chamber and in control room.

Generators.—Two Westinghouse, vertical type; 20,000 kw., 0.8 power factor, 25,000 kva., 11,000 volts, three phase, 60 cycle alternating current; 300 r.p.m.; equipped with brakes, jacks, fire coils. Exciters: Direct connected; 250



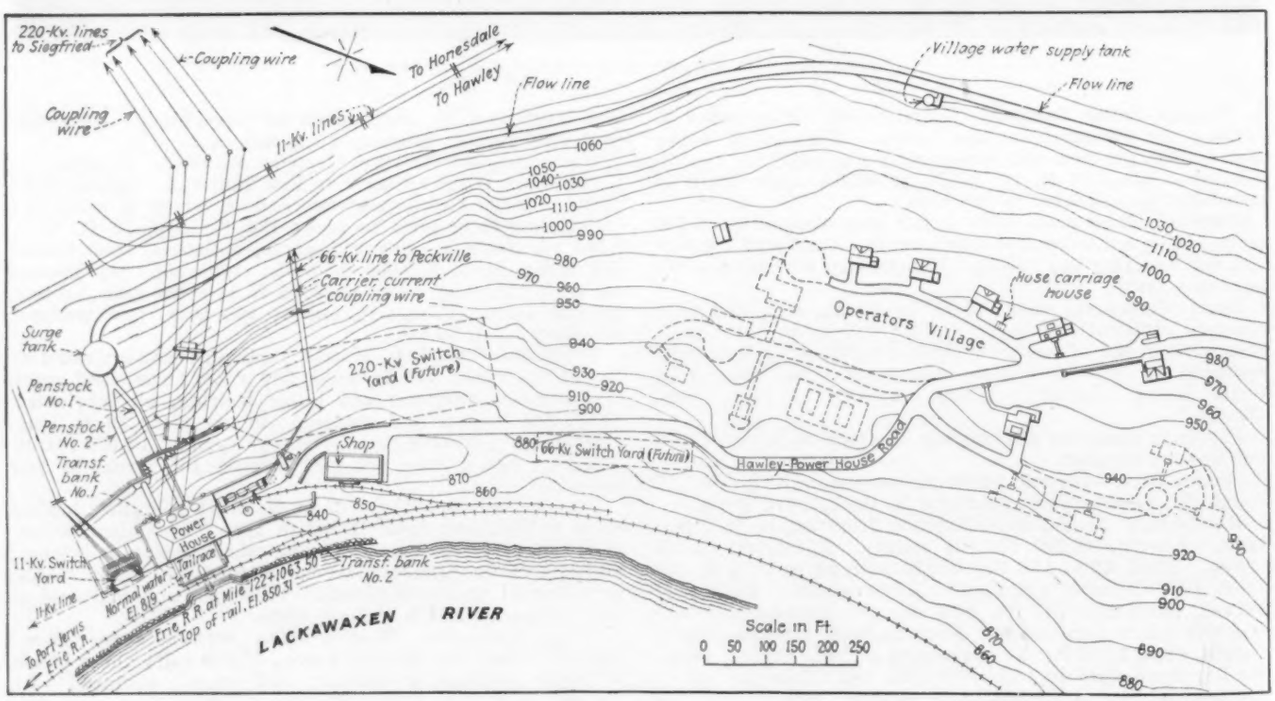
GENERAL PROFILE OF POWER WORKS, INCLUDING PLANT, PENSTOCK, SURGE TANK AND PART OF FLOW LINE

volts, 125 kw. Forty-inch Kingsbury thrust bearings, water cooled; at top of generators; maximum estimated load on thrust bearings, 312,000 lb. Guide bearings: Two, oil lubricated. WR^2—2,700,000 ft.-lb. Ventilation: Air enters top of generator, discharges through sides into stack terminating under crane rail; baffles exclude air currents from passing over guide bearings.

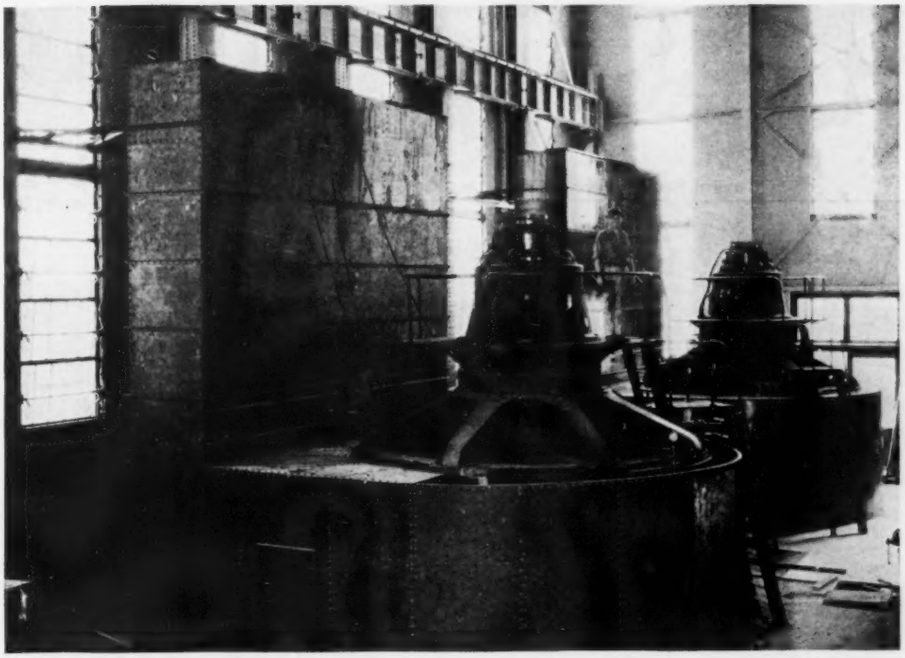
Heating Plant. — Two low-pressure boilers; larger one for use in extreme cold weather and also for protecting surge tank.

Tailrace and Railroad Bridge.—Tailrace: 72 ft. wide; lined with concrete across Erie Railroad right-of-way;

BANK OF 50,000-KVA., 11-KV. DELTA-220-KV. STAR OIL-INSULATED, WATER-COOLED TRANSFORMERS AT WALLENPAUPACK GENERATING STATION



GENERAL PLAN OF POWER STATIONS, SWITCH YARDS AND OPERATORS' VILLAGE



GENERATOR FLOOR IN WALLENPAUPACK STATION. NOTE AIR DUCTS IN GENERATOR ASSEMBLY

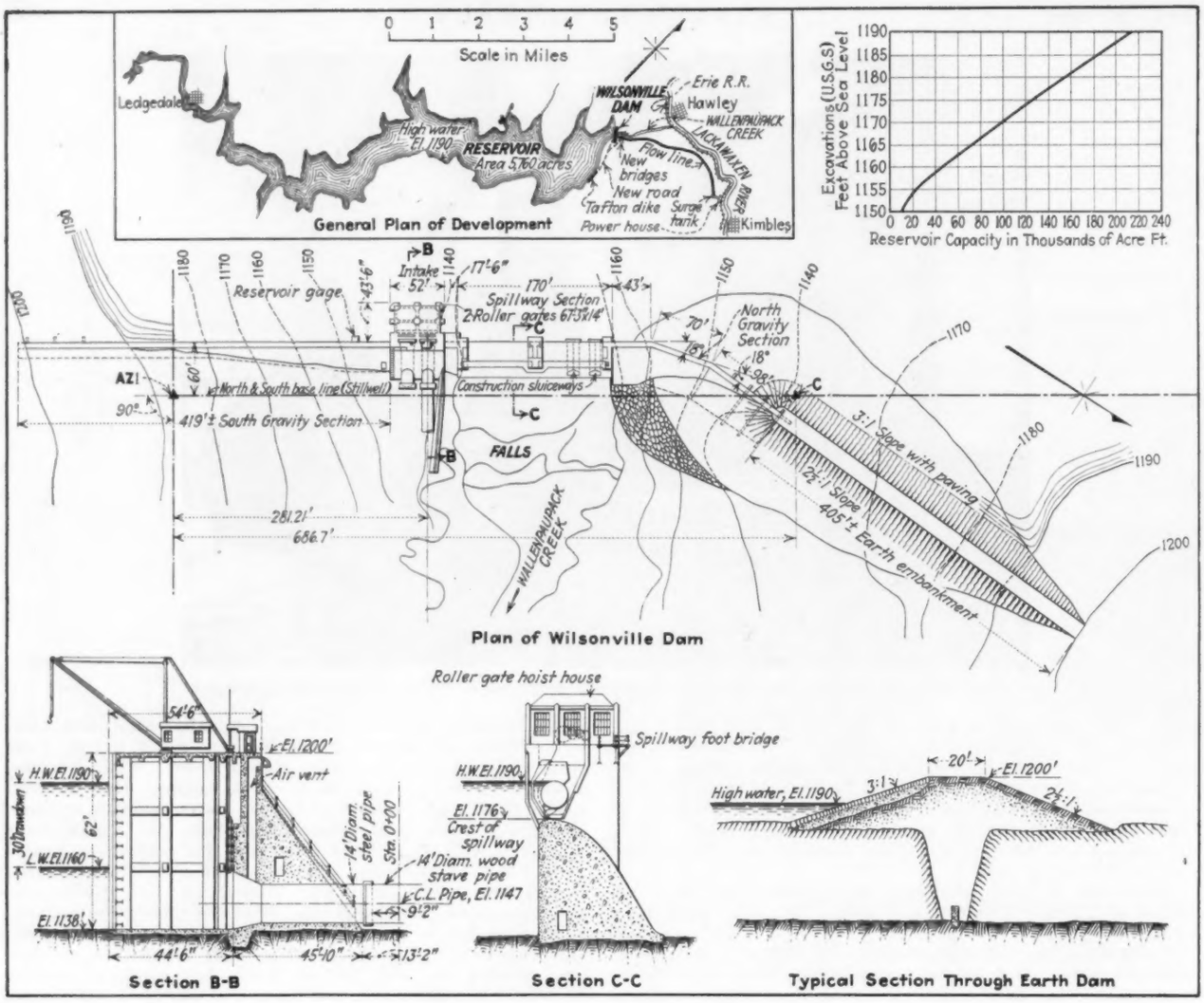
single-track railroad carried across it on two-span arch bridge; provision made for second track. Tailrace walls and railroad bridge carried on concrete piles in fine sand.

Shop and Garage.—Located 200 ft. west of power house on railroad spur and main highway to plant. One-story brick building containing machine shop, storeroom, three-car garage and offices. Facilities provided are for transmission district as well as for station.

Operators' Village.—Located one-fourth mile west of station on private highway to Hawley. Six tile and stucco houses; provision made for extensions.

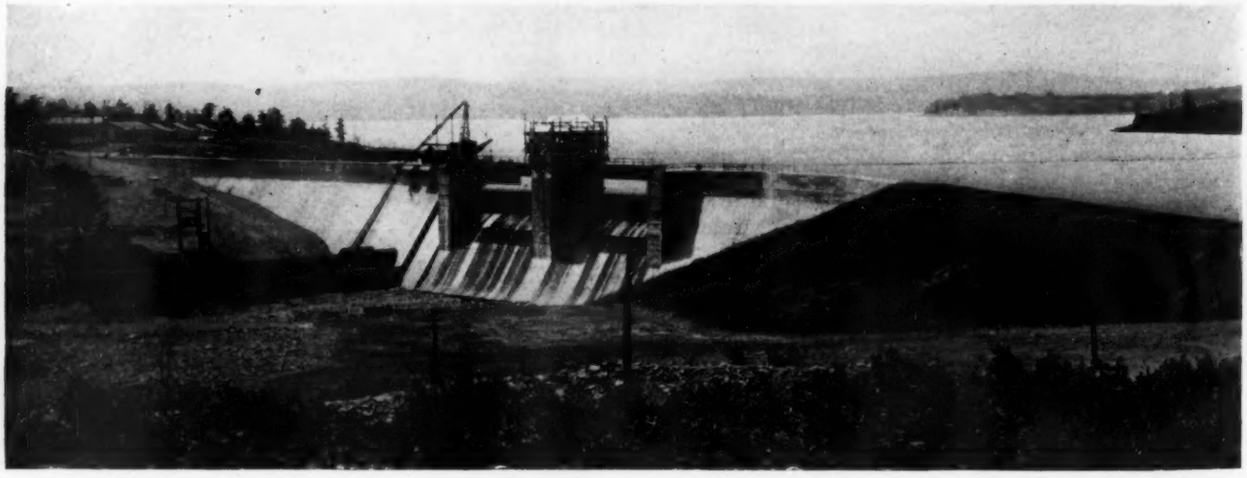
Major Construction Equipment.—All railroad equipment standard gage. Four 40-ton locomotives. Four miles railroad. Two flat cars, 80,000-lb. capacity. Twelve dump cars, 6 yd. Eight dump cars, 12 yd. One gasoline section motor car. Two caterpillar tractors, 5 ton. Three 1¼-yd. steam shovels. Five ¾-yd. steam shovels. One excavator, 1 yd. Three road rollers, 10 ton. One road roller, 13 ton. Four road graders. Two locomotive cranes, 30 ton. Four derricks, steel, 90-ft. masts with 80 to 90-ft. booms. One derrick, steel, 110-ft. mast and 100-ft. boom. Seven hoisting engines. One gravel washing and classifying plant, 100 tons per hour capacity. One 3-yd. drag line, used for conveying gravel from bank to receiving hopper at washer. Six concrete mixers, one 2 yd.; two 1 yd.; three ½ yd. One 1,400-cu.ft. air compressor, motor driven. Nine air compressors, portable; sizes 5x5 to 8x8. Two pile hammers. Eight centrifugal construction pumps varying from 5 to 12 in. suction. One planing mill for milling wood pipe staves; capacity 50,000 f.b.m. daily. One machine shop equipped with lathe, grinder, forge, shaper, radial drill, post drill, drill sharpener, punch, etc.; now installed in permanent machine shop.

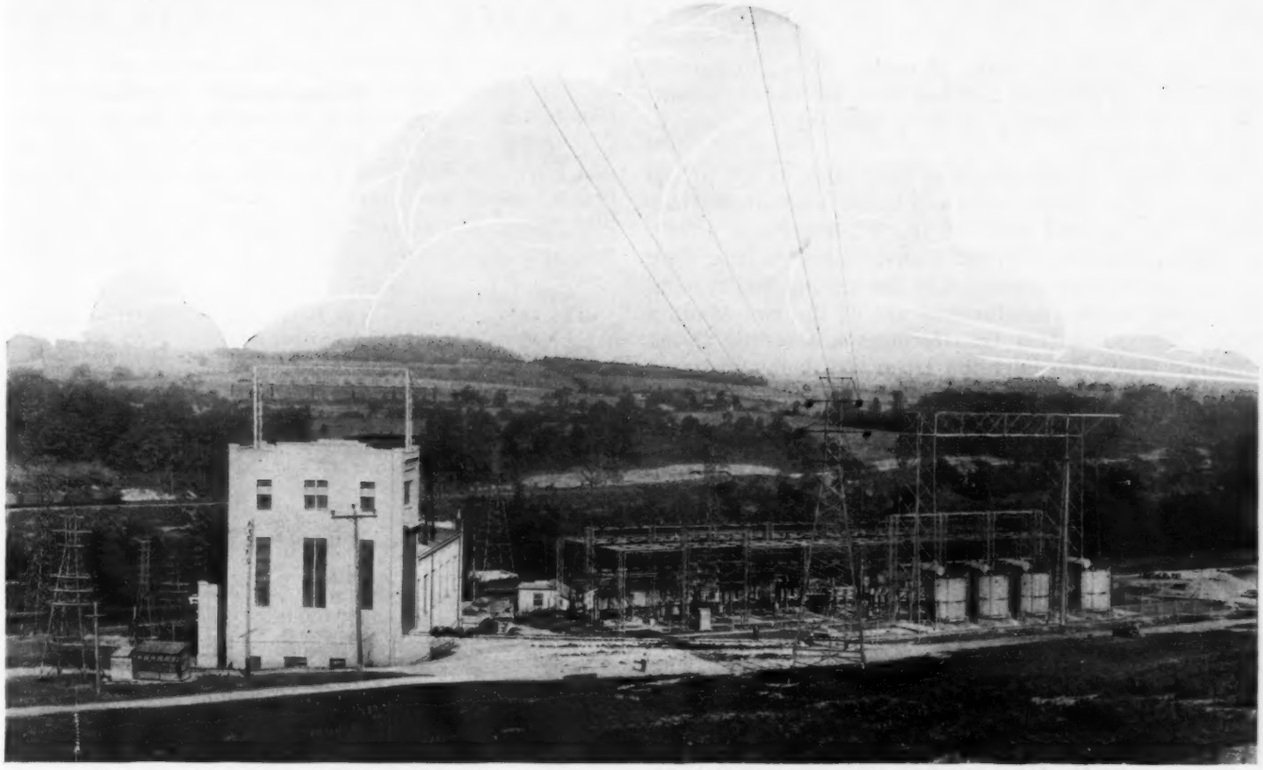
SPILLWAY OF WALLENPAUPACK DAM SHOWING ROLLER GATES INSTALLED AND STRUCTURE HOUSING HOISTING MECHANISM



Wallenpaupack Development of Pennsylvania Power & Light Company

THE illustration below shows Wallenpaupack dam and reservoir as viewed looking up the lake; above are cross-sections of earth dam and spillway arrangements with a general plan of development of the project. Transmission of power from the 40,000-kw. generating plant at Wallenpaupack over the 65 miles to Siegfried substation, near Allentown, will be at 220,000 volts and 60 cycles.





SIEGFRIED SUBSTATION, ARRANGEMENT OF 220-KV. TRANSFORMERS, 66-KV. SWITCHBOARD AND BUILDING

Wallenpaupack Hydro-Electric *and* 220-Kv. Transmission Development

PART TWO

Substations at Wallenpaupack and Siegfried

Step-Up and Step-Down Substations Laid Out to Co-ordinate with Existing Facilities—Tertiary Windings Provided for Step-Down Station Transformers—Design Details and Station Layouts

By A. E. Silver *and* A. C. Clougher

Electrical Engineer and Hydraulic Engineer, Respectively, Electric Bond & Share Company

THE transmission of the output from the 40,000-kw. Wallenpaupack generating station over the 65 miles to Siegfried does not, in itself, warrant a 220-kv. installation. Several years ago, when the present system was being organized through the consolidation of several smaller systems, a development plan looking to the future growth was worked out. This plan was based upon the building up of a 66-kv., 60-cycle network for transmission and main distribution duty, with a later step of 220 kv. as a standard trunk voltage. As it would not be economical to transmit the output from Wallenpaupack over 66-kv. circuits and as it is expected to bring in steam-generated energy from a contemplated large plant on the Susquehanna River, it was decided opportune to initiate this 220-kv. stage of the development plan with the Wallenpaupack transmission. It is also possible that additional generating capacity may be installed at Wallenpaupack in the future.

The initial 220-kv. installation is essentially that of transmission only, comprising in effect a single-circuit unit of step-up transformers, line and step-down transformers with no 220-kv. switches except for disconnecting purposes.

The Siegfried substation, where the energy from this development will be received, is located approximately ten miles north of Allentown. There is at present a well-established substation at this point which for several years has been receiving energy at 66,000 volts,

60 cycles and 110,000 volts, 25 cycles. The 220,000-volt installation is 60 cycles and has been laid out to co-ordinate with the existing facilities and with a view to future expansion.

The 220-kv. transformers at both stations are of the core type with circular coils and helical concentric windings. The neutral ends of the windings are solidly grounded through current transformers to the tank covers and in turn connected to the ground bus system. The power-house transformers are of the two-winding type. The substation transformers are of the three-winding type. Initially the latter are being operated with two windings only under load, the delta-connected tertiary being closed on itself. This tertiary winding is suitable for supplying synchronous condensers if required later.

The essential characteristics of these transformers are given in the accompanying table.

Arrangements are provided such that the spare transformer can be quickly put into service to replace any regular unit, by means of single-pole, double-throw switches in the 11-kv. leads and jumpers for the higher voltages. These jumpers form part of the main connections, and all that is necessary is to unbolt the end of the jumper and swing it to a bus cable on which the spare unit is always connected.

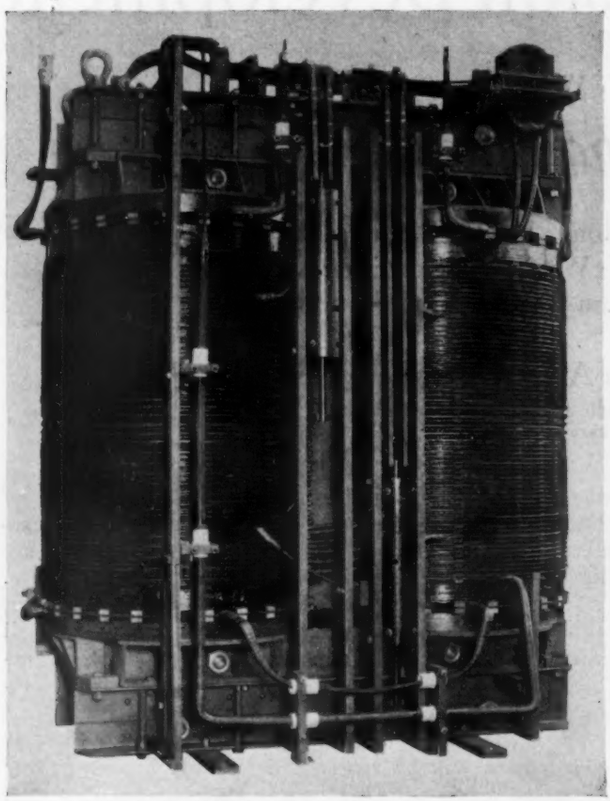
In designing the three-winding transformers at Siegfried the manufacturers have taken into account the possible future operation of these units with a buck or boost regulating transformer as a device for changing taps under load. This Siegfried transformer is the largest capacity single-phase unit manufactured up to the time of this installation.

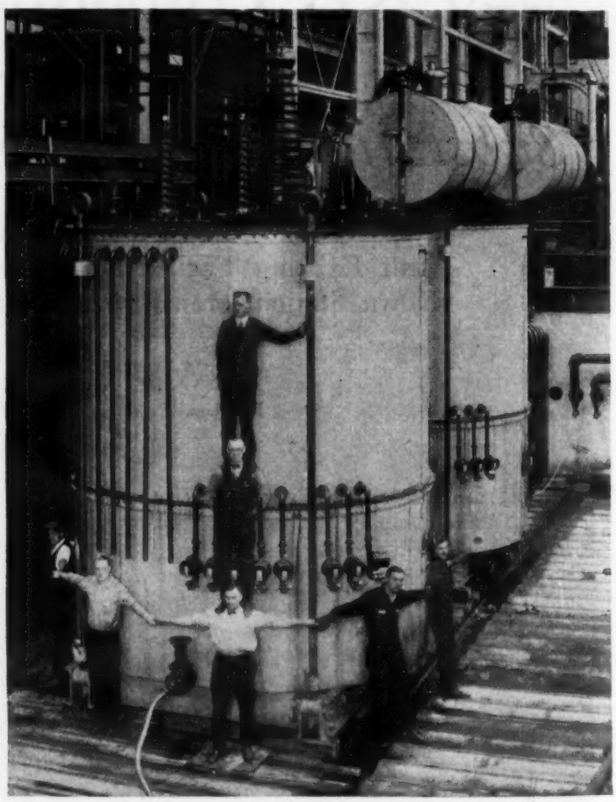
The ultimate switching scheme contemplates using oil circuit breakers. At present, however, only a motor-operated 220-kv. disconnecting switch is installed at the Wallenpaupack and the Siegfried ends of the transmission line, all switching for power interruption being taken care of by means of the low-voltage breakers.

	Wallenpaupack	Siegfried
Manufacturer	Gen. Electric Co.	Gen. Electric Co.
Bank rating	50,000 kva.	86,600 kva.*
Number S P units	4 (one spare)	4 (one spare)
High voltage	134,000/231,000 Y	127,000/220.000 Y
High voltage	127,000/220.000 Y	121,000/209,000 Y
High voltage	121,000/209,000 Y	114,000/198,000 Y
Low voltage	11,000 Delta	38,000/ 66,000 Y
Tertiary voltage	.....	10,700 Delta
Guaranteed efficiency		
4/4 load	98.75 per cent	98.90 per cent†
3/4 load	98.85 per cent	98.95 per cent†
2/4 load	98.80 per cent	98.80 per cent†
Guaranteed regulation		
100 per cent p.f.	2.1 per cent	1.50 per cent
Guaranteed reactance		
220/11 kv. winding	14 per cent	18 per cent
Guaranteed reactance		
20/66 kv. winding	.....	12 per cent
Guaranteed reactance		
66/11 kv. winding	.....	4.7 per cent
Floor space	15 ft.x10 ft. 6 in.	15 ft. 6 in.x 12 ft. 6 in.
Height over cover	14 ft.	16 ft. 2 in.
Height over bushing	21 ft. 6 in.	24 ft.
Total weight S P unit	110,000 lb.	202,000 lb.
Weight of oil S P unit	43,700 lb.	79,000 lb.

*The capacity of the bank, when operating as a three-winding transformer, is 86,600 kva. in the 66-kv. winding, with 75,000 kva. on the 220-kv. winding and the 11-kv. winding operating full loading at 60,000 kva.

†Efficiency based on 75,000 kva. operating 220/66 kv., with 11-kv. winding idle.





SOME OF THE EQUIPMENT IN SIEGFRIED SUBSTATION

At left, core and coils of 28,866-kva., 220/66/11-kv. single-phase transformer unit. Ratio adjusters and coil connections can be seen. At right, exterior view of the 28,866-kva. transformer unit

The switch at Wallenpaupack, manufactured by the Electric Power Equipment Corporation, is of the tilting type, having four stacks of insulators per phase, the two outer stacks having six units and the two inner, or tilting, stacks having seven units of Locke catalog No. 7785 post type insulators. Each stack is equipped with a 34-in.-diameter grading ring of 2-in.-diameter iron pipe, located approximately at the top of the stack and horns located at the bottom.

The switch at Siegfried substation, manufactured by the Railway & Industrial Engineering Company, is of the rotating insulator type, having the same number of stacks of insulators, rings and horns as described above, except that all posts have six units per stack.

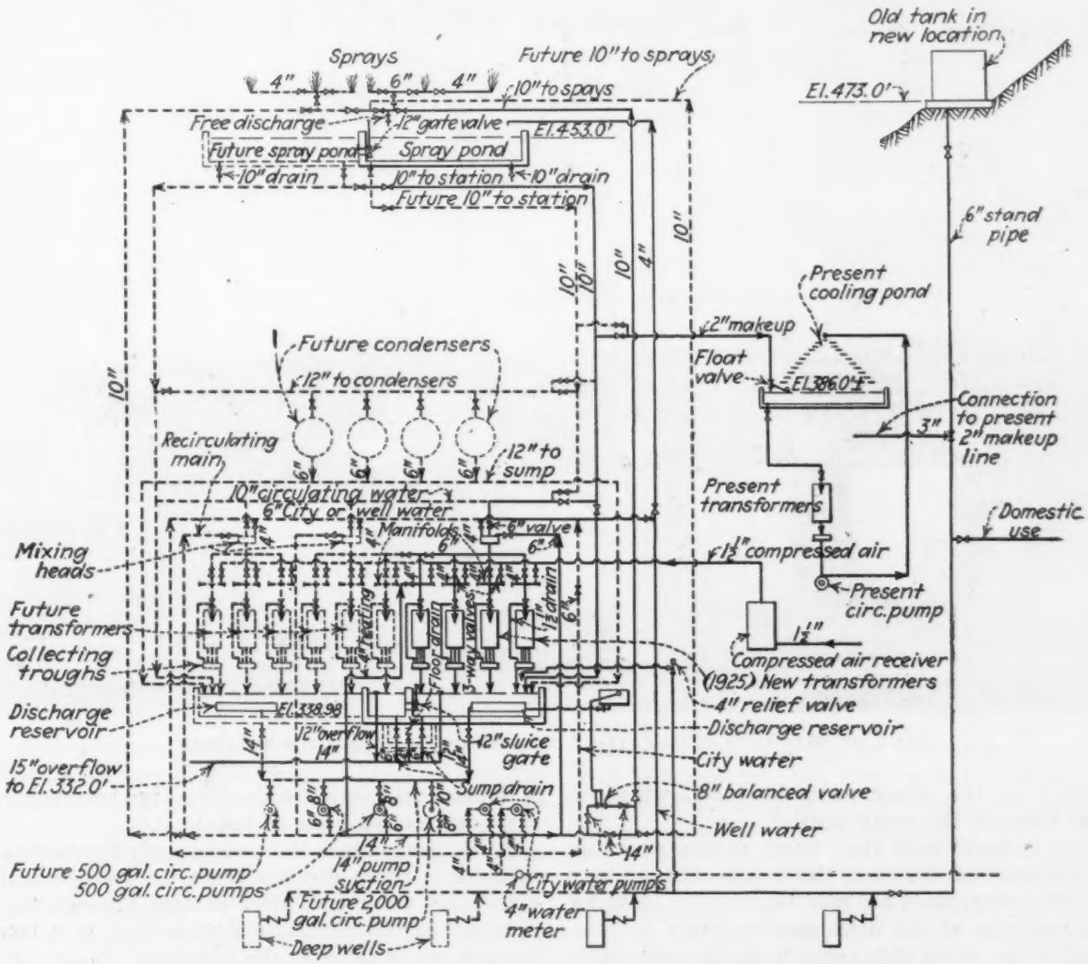
Switches May Be Jumpered

Provision is made in each switch for using a jumper underneath when it is desired to bypass the working parts. A 3-hp. direct-current motor is used to drive the operating mechanism. This is protected by means of an overload relay, set to disconnect the motor from the control circuit when the load exceeds 6 hp.

Both switches have a 20-ft. phase separation and the minimum separation between live parts when the switch is in the open position is 9 ft. 6 in.

Mechanical tests were made, including a 24-hour continuous run of opening and closing, the time for opening being 14 seconds and the time for closing being 10½ seconds; total cycle 31 seconds.

For handling the transformers an extension was made to the present building, consisting of steel framing with brick walls and stucco finish on the outside. A railway spur track from the main line of the Central Railroad of New Jersey runs into this extension, where apparatus can be unloaded and assembled by means of an electrically operated 125-ton crane. Another track is run into this extension 17 ft. above the assembly floor, which is used for transporting the transformers to their stalls by means of a transfer car. Pulling blocks are located along the track for moving this transfer car.

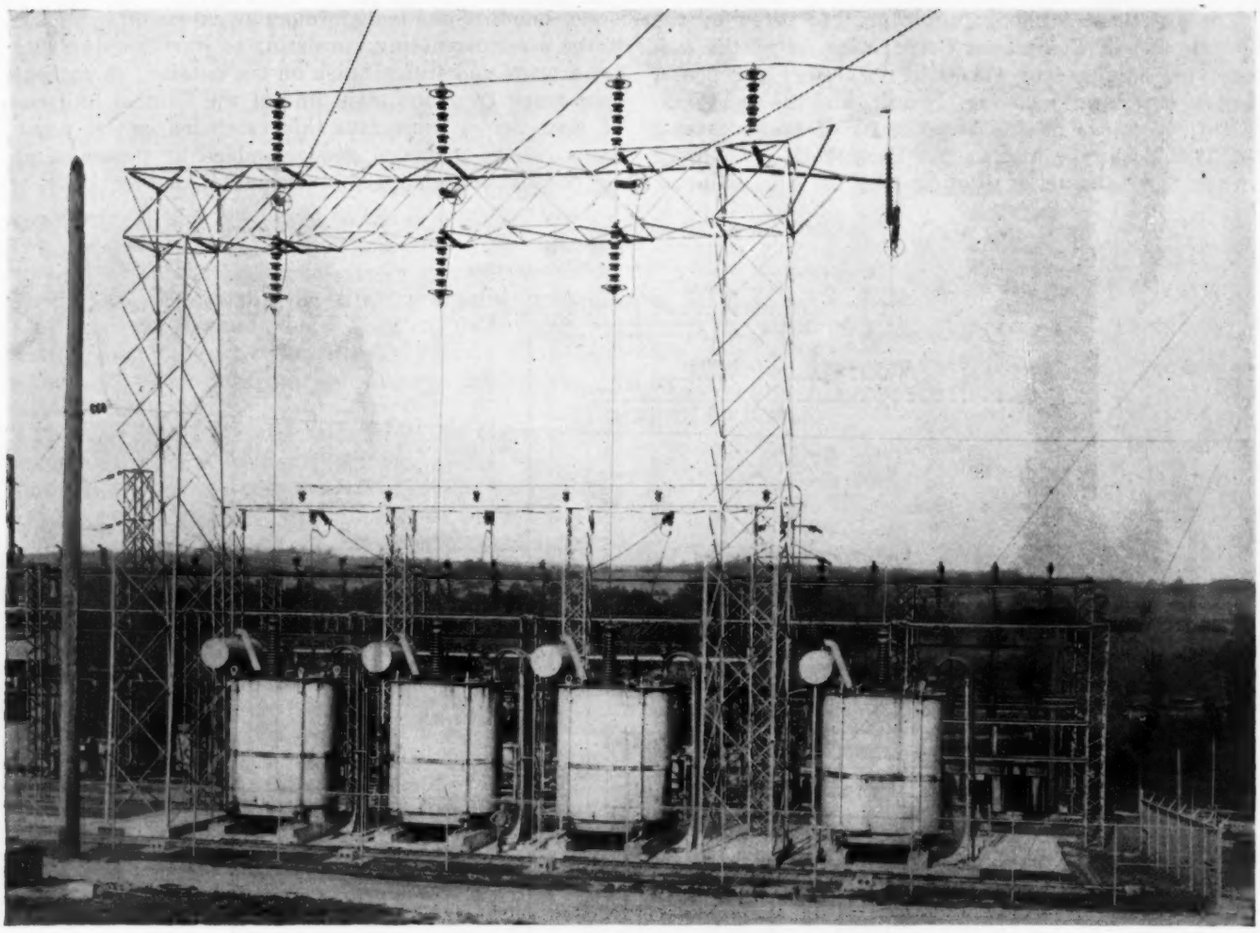


SCHEMATIC DIAGRAM OF COOLING WATER SYSTEM, SIEGFRIED SUBSTATION

Details of Cooling Water Systems

At Siegfried water is pumped from deep wells into supply mains, which connect in multiple into a storage tank, a spray pond reservoir and the transformer distribution manifolds. The feed into the spray pond reservoir is controlled by a float valve. The normal supply into the transformer manifolds is from an additional main direct from the spray pond reservoir. The water level in the storage tank is approximately 120 ft., and in the spray pond reservoir approximately 100 ft., above the base of the transformers.

The transformer discharge passes through water-flow indicators with electric attachments for no-flow alarm, thence passes to an open inspection trough and then flows into a discharge reservoir in the base of the transformer foundations. The water is then passed to pumps, in a room incorporated in the transformer foundations.



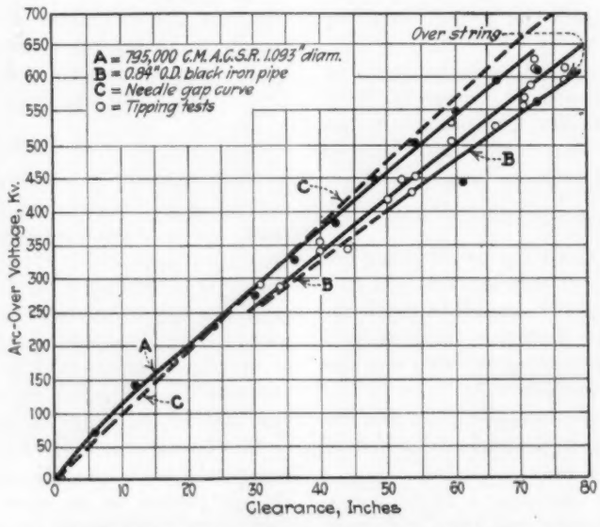
BANK OF 86,600-KVA. 220/66/11-KV. TRANSFORMERS, SIEGFRIED SUBSTATION

which lift it to the spray pond reservoir, where it discharges through the spray nozzles.

Provision is made such that warm discharge water may be recirculated through the spare unit or any transformers, compressed air may be used for cleaning out coils, one side of the discharge reservoir may be cleaned while the other side remains in use and regulating pumps will be started and stopped automatically in the event the water in the discharge reservoir reaches a predetermined high or low level.

At Wallenpaupack the water supply for cooling transformers is taken directly from the penstocks through a reducing valve and, after passing through the transformers, indicating alarm devices and open inspection troughs, as is done at the Siegfried station, it is discharged into the tailrace.

WITH insulator grading and shielding rings carefully worked out, the desirability of establishing the spark gap of the insulator assembly as the point at which any arc should initiate is evident. This led to thorough checking by actual test as to clearances that must be maintained between live parts and structures at other points to reasonably insure this condition.



TESTED STRIKING VOLTAGES WITH ACTUAL TOWER AND INSULATOR ASSEMBLY IN VARIOUS RELATIVE POSITIONS

TESTS conducted on the pillar insulator assembly with ring and horns as used for station buses and equipment showed closely similar striking voltage values to those obtained with the line insulator assembly. Careful attention was then given in designing all conductor assembly relative to structures to insure a reasonable margin of safety of striking distance to ground.

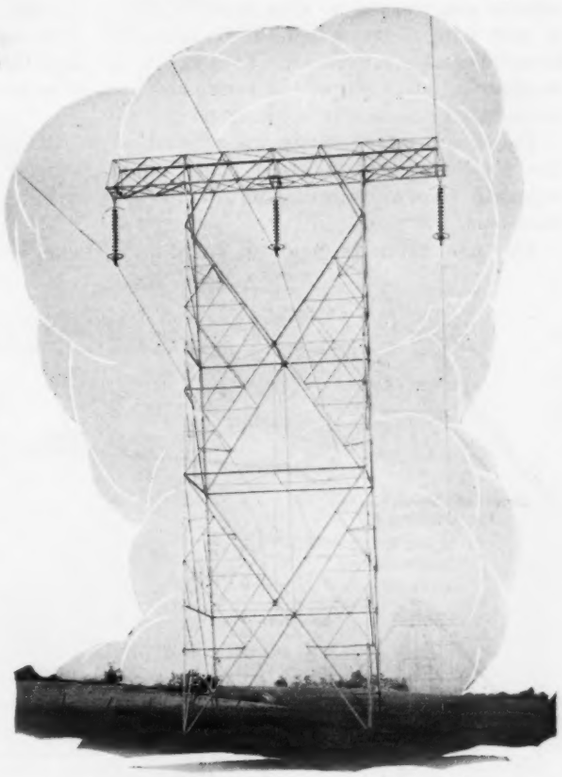
Wallenpaupack Hydro-Electric *and* 220-Kv. Transmission Development

PART THREE

The Transmission Line

Sleet Loads Guarded Against in Line Design—High-Strength Insulators Used—Pivoted-Base Guyed Structures Used on Angles—Special Splicing Sleeve and Conductor Clamp Developed

By A. E. Silver *and* A. C. Clougher
Electrical Engineer and Hydraulic Engineer, Respectively, Electric Bond & Share Company



STANDARD TYPE A SUSPENSION TOWER

IN UNDERTAKING the design of this line, it was recognized that excessively heavy sleets prevail through the territory to be traversed. A careful study showed that the severity and frequency of the sleet loads were greatest above an elevation of about 1,000 ft., and especially so over the highest ridges.

It was the aim adequately to safeguard against these sleet load conditions in the design. Loading assumptions for the conductors were placed sufficiently high to meet any climatic condition reasonably probable to be encountered. With the towers, the loading assumptions were further increased to be safe against any possible sleet condition.

It was recognized that repair of a tower failure is far more serious than repair of a conductor failure and that a high-strength conductor of the order required, if firmly attached to supporting towers of sufficient strength to withstand the unbalanced pull of one or more broken conductors, would cause these towers to be excessively heavy and expensive. The conductor attachment therefore incorporates a clamp designed with a grip adequate for any differential of tension in the conductor while intact, but which will slip and relieve the tower at an unbalance of tension well under that which would occur with the conductor broken.

At angles and dead-end points in the line where overturning loads on the towers must be carried constantly, a guyed mast type of structure was used. This effected a large material and cost saving in both structure and foundation as compared with what would have been required to meet the heavy loads with the conventional type of rectangular self-supporting tower.

Stabilization of Conductors in Line

A new method, termed the suspension anchor, was applied for stabilizing the position of the conductor in tangent stretches, required in a few places because of unusual ground profile. At these points, the conductors were carried straight through on suspension insulators with insulated guys, both forward and back, extending at 45 deg., in the vertical plane of the conductor, from the supporting clamp to an anchor in the ground.

Electrically, the increase in inductance for the steel core cable used, the characteristics of which are shown in an accompanying table, was found so small that it has practically little importance, resulting from the layers of the aluminum strands over the steel being stranded cross-lay, each succeeding layer tending to neutralize the effect of the adjacent layer.

An improved conductor

Conductors for 220-Kv. Line

795,000 circ.mil ACSR, 54 strands of aluminum in three layers and 7 strands of steel

Copper equivalent of aluminum	500,000 c.m.
Over-all diameter	1.093 in.
Diameter of strands	0.1214 in.
Weight per foot	1.024 lb.
Listed elastic limit	19,250 lb.
Listed ultimate strength	27,950 lb.
Tension at assumed maximum load	18,000 lb.
Tension at 60 deg. F.	
4,900 lb. in 1-in. radial sleet zone	
3,320 lb. in 1½-in. radial sleet zone	
Test pull before sagging	18,000 lb.
Overhead ground clearance:	
30 ft. at 120 deg. F.	
25 ft. at maximum load	

splice was developed by the conductor manufacturer, the Aluminum Company of America, whereby the steel and aluminum are separately joined by concentric sleeves compressed by dies in a 100-ton hydraulic jack. A soft iron sleeve was used for the steel core and an aluminum sleeve over all. This splice develops the full mechanical strength of the conductor and gives greater conductivity than the cable itself.

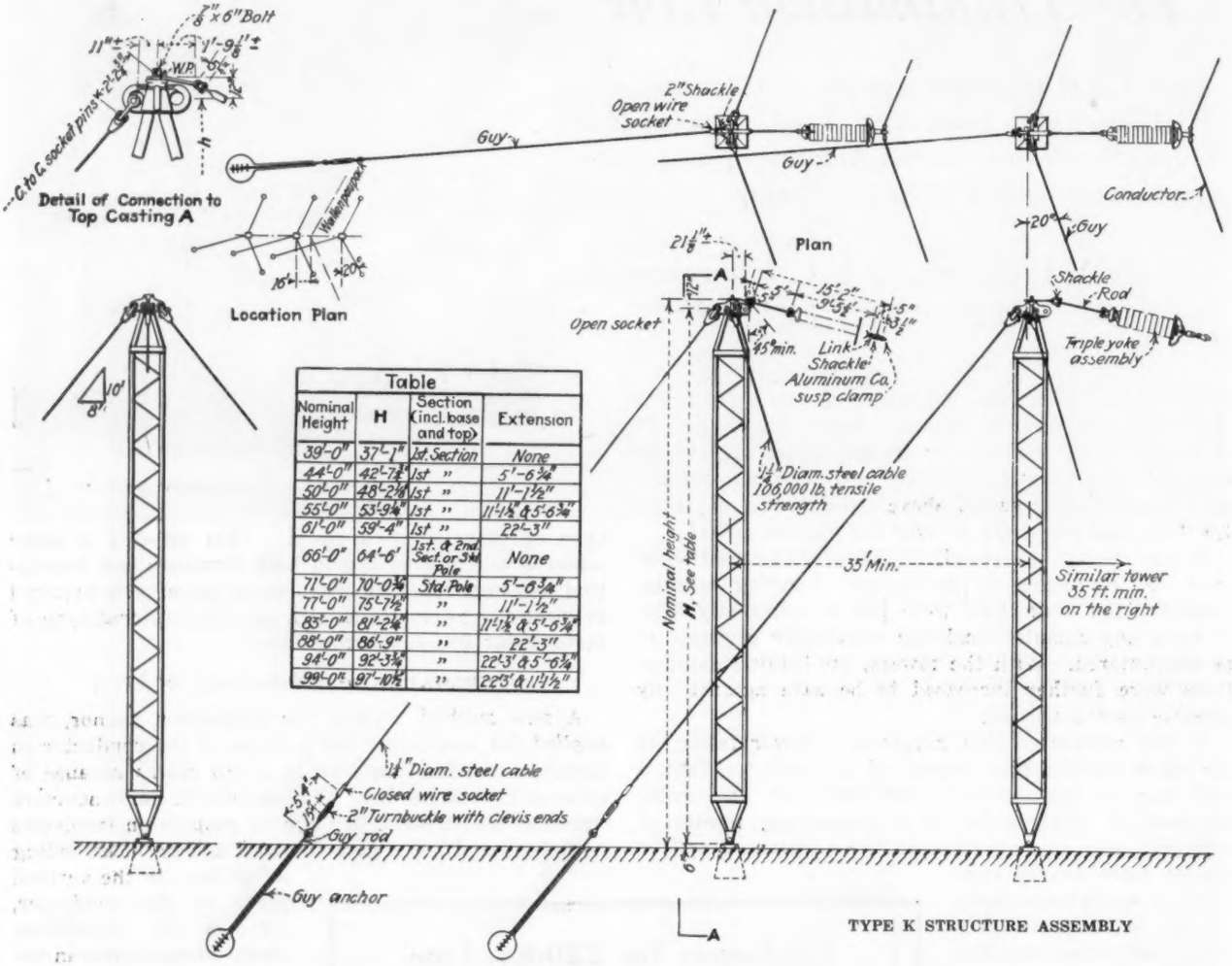
The dead-end clamp is an adaptation of the splice, the steel-core and over-all cable being pressed into separate sleeves terminating in clevices with a common bolt.

The conductor is held at suspension towers by a forged aluminum clamp especially designed with a spring grip so that the conductor will slide through whenever there is a differential in longitudinal pull exceeding 4,000 lb.

During the stringing process and before final sagging the conductor was subjected to a test pull of 18,000 lb. for three minutes. This served two purposes: It stretched the conductor to its permanent set at the outset, so that under normal conditions, due to the relative characteristics of the two metals, the aluminum strands take very little tension; also, it subjected the entire conductor assembly to a mechanical check of materials and workmanship at maximum load.

The conductor was permanently sagged for a tension of 18,000 lb. at maximum assumed load. With the tower spacing used, calculations show, assuming an extreme ice loading, that the conductor should stretch to the degree of touching the ground before the ultimate strength of 27,950 lb. has been reached.

The conductor was pulled out under sufficient tension so that it was kept clear of the ground. This prevented damage of the strands. Equipment used for pulling out was a Fordson tractor belted to a winch which wound in approximately 100 ft. of lead pipe per minute. The tension was regulated at the pay-out end by a heavy specially designed braking drum. This was supplemented by a light tension maintained on the cable reel by an adjustable brake on the reel jack.

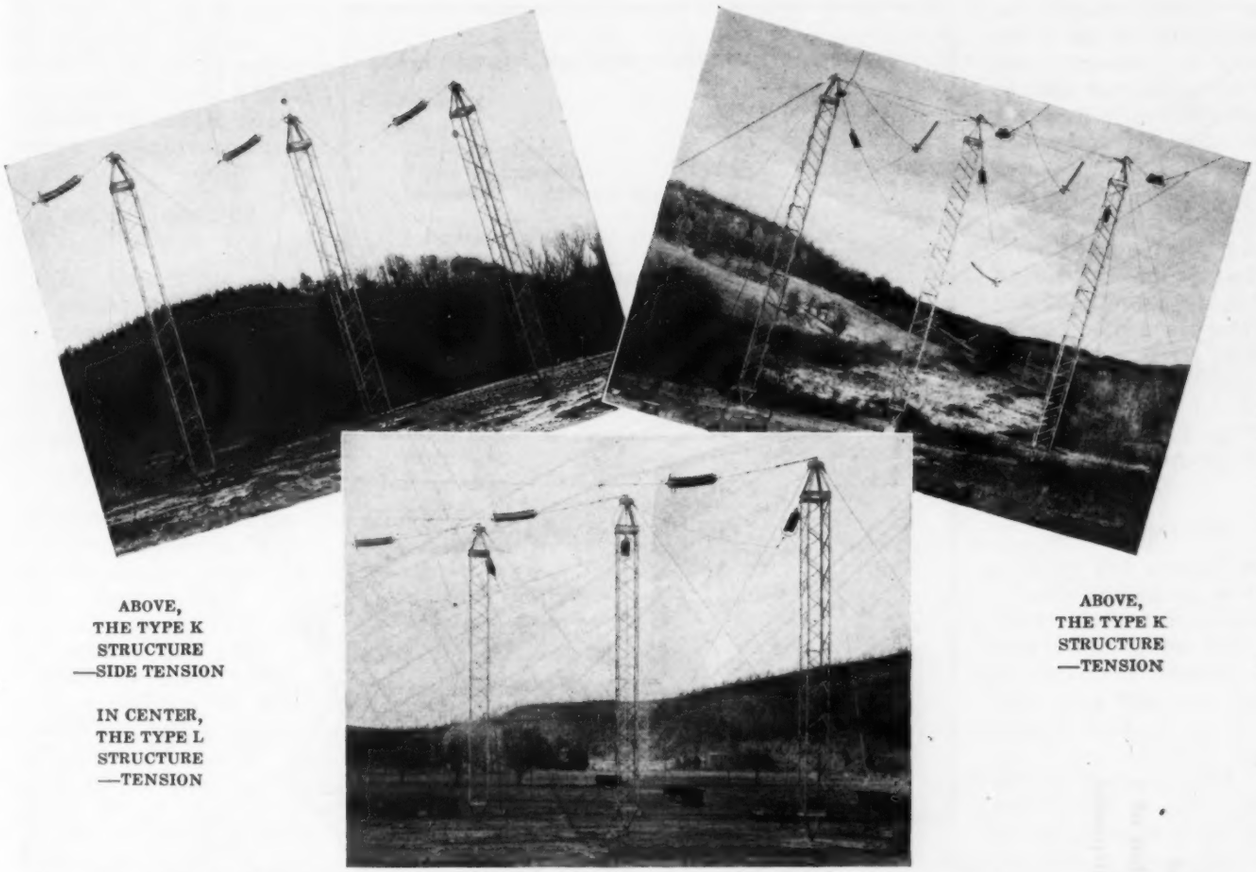

7/8" x 6" Bolt
11" ±
1'-9 1/8" ±
W.P.
C. to C. socket pins ± 2'-2 3/8"
Detail of Connection to Top Casting A
Guy
2" Shackle
Open wire socket
Guy
Conductor
20°
Guy
Plan
21 1/8" ±
A
Shackle
Rod
Triple yoke assembly
Open socket
45° min.
Link Shackle Aluminum Co. susp clamp
1/2" Diam. steel cable 16,000 lb. tensile strength
35' Min.
Similar tower 35 ft. min. on the right
Nominal height H, See table
Location Plan
Table
Nominal Height | H | Section (incl. base and top) | Extension
39'-0" | 37'-1" | 1st Section | None
44'-0" | 42'-7 3/8" | 1st " | 5'-6 3/4"
50'-0" | 48'-2 1/8" | 1st " | 11'-1 1/2"
55'-0" | 53'-9 1/4" | 1st " | 11'-1 1/2" & 5'-6 3/4"
61'-0" | 59'-4" | 1st " | 22'-3"
66'-0" | 64'-6" | 1st & 2nd Sect. or 3rd Pole | None
71'-0" | 70'-0 3/8" | Std. Pole | 5'-6 3/4"
77'-0" | 75'-7 1/2" | " | 11'-1 1/2"
83'-0" | 81'-2 5/8" | " | 11'-1 1/2" & 5'-6 3/4"
88'-0" | 86'-9" | " | 22'-3"
94'-0" | 92'-3 3/4" | " | 22'-3' & 5'-6 3/4"
99'-0" | 97'-10 1/2" | " | 22'-3' & 11'-1 1/2"
1/4" Diam. steel cable
Closed wire socket
2" Turnbuckle with clevis ends
Guy rod
Guy anchor
A

TYPE K STRUCTURE ASSEMBLY

At each tower the conductor was carried over a heavy snatch block with grease-packed roller bushing especially designed for free running and ruggedness. The sheave was cast from aluminum and had an over-all diameter of 14 in. and a groove depth of 1¾ in.

CLEARANCES FOR LIVE PARTS

The electrical clearances from live parts to tower members were based largely on the experience with existing lines reporting good operating results. Confirmatory tests were then made at the Pittsfield laboratory of the General Electric Company with various combinations of insulators, arcing horns, rings and other grading devices. The condition of insulator swing was effected by tilting the tower. These tests were



ABOVE, THE TYPE K STRUCTURE —SIDE TENSION

IN CENTER, THE TYPE L STRUCTURE —TENSION

ABOVE, THE TYPE K STRUCTURE —TENSION

made on the standard type A tower. Several types of structures were used on the line as indicated in the following tabulation:

Type A—Rectangular, self-supporting, suspension tower, standard.

Type B—Rectangular, self-supporting, suspension tower, for medium long spans and small angles.

Type B-SA—Rectangular, self-supporting tower, suspension anchor for conductor stabilizing. This is type B with conductor anchor guys added.

Type C—Rectangular, self-supporting tower, suspension, for long spans and small angles.

Type K-ST—Guyed mast, side tension structure, for large angles.

Type K-T—Guyed mast, dead-end structure, for large angles.

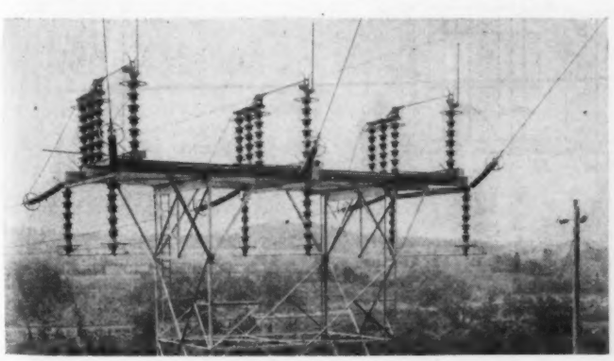
Type L—Guyed mast, dead-end structure, for small angles.

The longitudinal strength of the type A tower is only 10,000 lb. The safety of the tower is maintained under the broken conductor condition by relief from slippage of the special suspension clamp described.

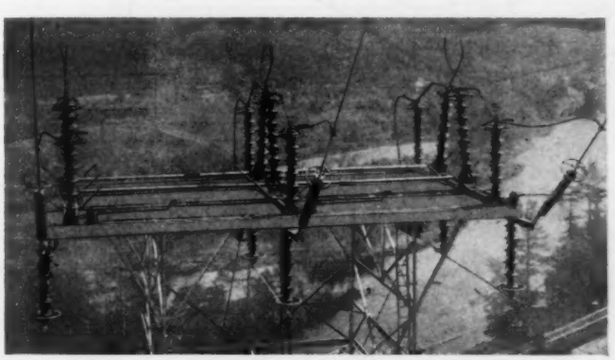
Approximately every tenth structure is a type B tower, which will permit the addition of suspension anchor construction at these locations for stabilizing the conductor if experience should show this to be desirable. Care was taken to spot the towers so that unbalanced sleet loading would not put the conductor dangerously near the ground in any span. Ice on one span and off other spans will not cause slippage of the conductor through the suspension clamp. The studies of this problem brought out prominently that when long spans and long pendulum insulator assemblies are used this question of unequal sleet loading becomes a very important factor in locating towers so as to maintain ground clearances. Tower design data are given in tabular form.

Special Structures for Angles and Dead Ends

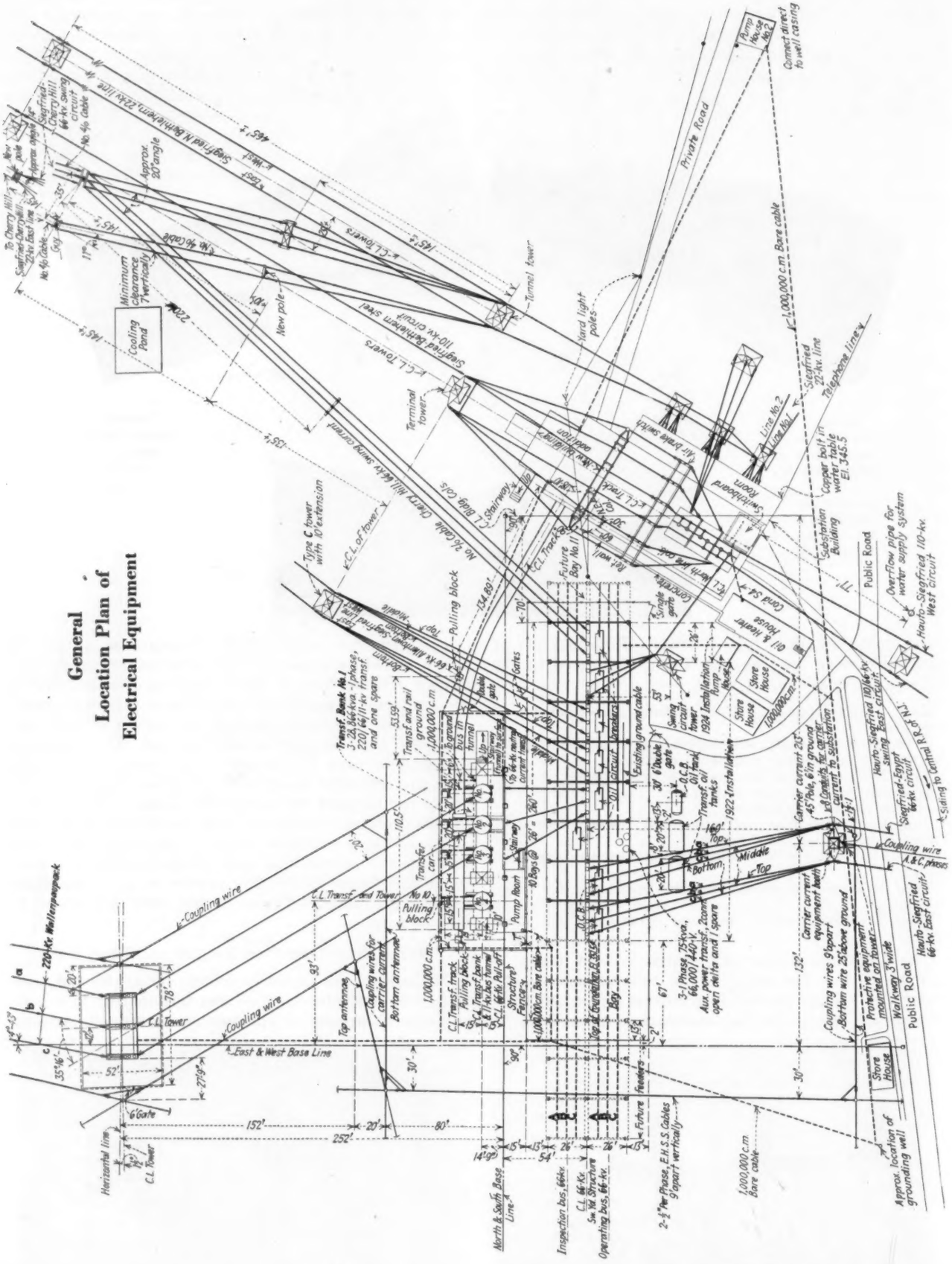
The mast of the guyed structures for angles and dead ends is a fabricated steel column terminating in a ball-and-socket support at the base to avoid all bending



THE 220-KV. ROTATING INSULATOR-TYPE DISCONNECTING SWITCH AT SIEGFRIED SUBSTATION



THE 220-KV. TILTING INSULATOR-TYPE DISCONNECTING SWITCH AT WALLENPAUPACK GENERATING STATION


General
Location Plan of
Electrical Equipment
Cooling Pond
Minimum clearance 7 vertically
Siegfried-Buhlmann 22-kv line
Cherry Hill 66-kv swing circuit
No. 4/0 cable
Approx. 20° angle
C.L. Towers
Tunnel tower
New pole
Siegfried-Buhlmann 110-kv circuit
Terminal Tower
Yard light poles
Private Road
Pump House No. 3
Connect direct to well casing
1,000,000 c.m. Bare cable
Siegfried 22-kv line
Telephone line
Line No. 2
Line No. 1
Air brake switch
Substation Building
Copper bolt in water Table El. 345.5
Overflow pipe for water supply system
Hauto-Siegfried 110-kv. West circuit
Public Road
Oil & Heater House
Store House
Transf. Bank No. 1
3-28,346-kva. 1-phase, 220/66/11-kv transf. and one spare
Transf. and rail ground 1,000,000 c.m.
Bus tunnel
Pulling block
Gates
Existing ground cable
Swing circuit tower 1924 Installation
Transf. oil tanks 1922 Installation
Carrier current 25 45° Pole, 6 in ground
Coupling wires for carrier current to substation
Hauto-Siegfried 110/66-kv swing East circuit
Siegfried-Egypt 66-kv circuit
Siding to Central R.R. of N.J.
Coupling wire A & C phases
Top
Middle
Bottom
Coupling wire
220-Kv. Wallenpaupack
C.L. Tower
East & West Base Line
Coupling wires for carrier current
Top antennae
Bottom antennae
Pump Room
Transfer car
No. 10 Pulling block
Carrier current equipment hut
Coupling wires 9' apart
Bottom wire 25' above ground
Protective equipment mounted on towers
Walkway 3' wide
Hauto-Siegfried 110/66-kv East circuit
Public Road
Store House
Approx. location of grounding well
1,000,000 c.m. Bare cable
Horizontal line
C.L. Tower
North & South Base Line
Inspection bus, 66-kv.
C.L. 66-Kv. Sw. Yd. Structure
Operating bus, 66-kv.
2-3/4" Phase, 5' H.S.S. Cables 9' apart vertically
Future
Feeders
6' Gate
152'
252'
20'
80'
54'
67'
122'
30'
53'
78'
52'
27'9"
35'6"
105'
134.89'
53.59'

stresses. It was designed in standard sections of such lengths as to enable assembling in any desired over-all height in increments of approximately 5 ft.

DETAILS OF GUY CABLES

The guy cable used with these structures is of medium, high-strength steel, galvanized. It has an over-all diameter of 1¼ in. and is made up of 35 strands in four layers. The guy cables terminate in a cast-on socket at each end with a long extension turnbuckle, completing the connection to the anchor rod. The guaranteed ultimate strength of the cable is 106,000 lb. after socketing. Actual lengths were given the manufacturer and each guy was socketed and shipped ready to install. These guys were sagged to 6,000 lb. tension at 60 deg. F. This was done by sagging parallel to a small copper wire the tension of which was adjusted on a spring balance. The tension in the guy was then that tension shown on the spring balance, multiplied by the weight per foot of guy cable, divided by the weight per foot of copper wire.

MALONE ANCHORS AND CONCRETE FOOTINGS FOR RECTANGULAR BASE TOWERS

Before deciding on the type or size of footing that would be used exhaustive tests were made on single- and double-ball Malone anchors in compression and uplift. Based on these results, it was decided to use double-ball Malone anchors on all rectangular base towers. Where swamps were encountered a special type of grillage and concrete footing was used.

It was expected that a large percentage of the footings could be installed by the Malone process—that is, boring a 5-in. hole to the proper depth and expanding a cavity at the bottom by explosives. A deformed angle is then grouted in by filling the cavity and shaft to the ground surface.

SOIL CONDITIONS

When the ground was actually opened up, it was found that over a large proportion of the line it consisted of broken or loose rock that was very difficult to bore or drill. In this broken rock ground it was found advantageous to sink holes in the manner usual for pole holes with handy digging tools. The same deformed steel members were then installed by pouring a concrete ball at the lower end, which keyed firmly around the protruding stones. The remainder of the hole to the ground surface was back filled.

The tower footings were set with light templets individual for each corner, the batter and position of each being determined by a tapered level board and measurements from reference pegs. More accurate settings in quicker time were obtained in this way than on other jobs where heavy steel templets embracing four corners of the tower were used. Each drilling and footing gang included a competent transitman, who was

General Characteristics of the Line

Frequency ..... 60 cycles
Voltage—
- Between phases ..... 220,000 volts
- Phase to ground ..... 127,000 volts
- Insulation to ground, 60-cycle dry flashover ..... 600,000 volts
- Insulation to ground at lightning frequency, dry or wet ..... 1,500,000 volts
- Neutral dead grounded at each transformer installation

Circuits ..... One
Right-of-way—
- Secured mostly by easements; 100 ft. cleared and danger timber cut

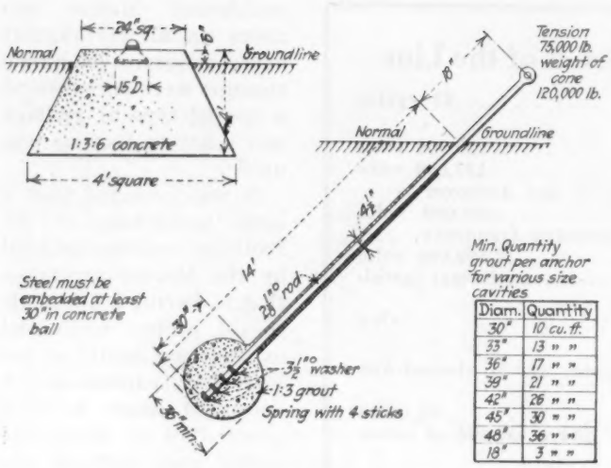
Length ..... 65 miles
Normal height of conductor above ground at tower 65 ft. 7 in.
Normal span—
- 1,100 ft. in 1-in. radial sleet zone
- 950 ft. in 1½-in. radial sleet zone

Average span ..... 1,108 ft.
Maximum span ..... 2,400 ft.
Altitude of conductor—
- Average, 1,020 ft.
- Maximum, 1,620 ft.
- Minimum, 464 ft.

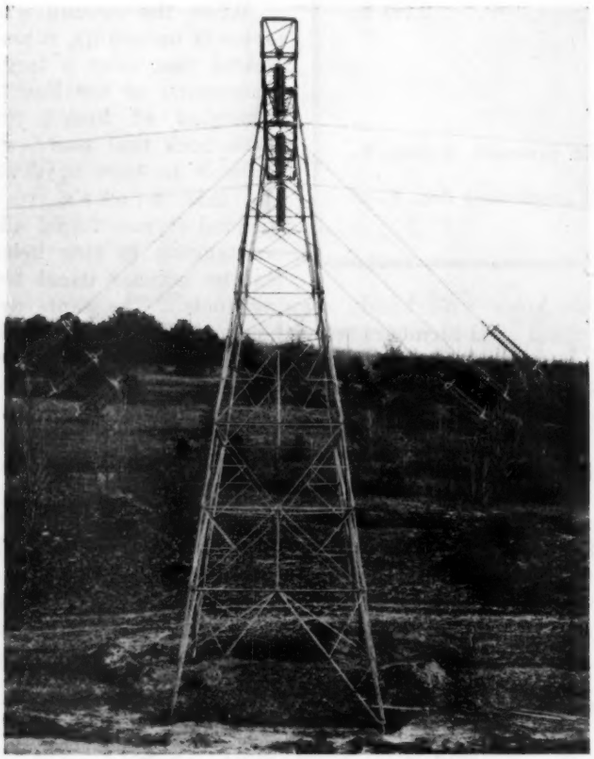
Assumed maximum loading—
- 1 in. radial ice, 8 lb. wind pressure, 0 deg. F., regular
- 1½ in. radial ice, 8 lb. wind pressure, 0 deg. F. at locations most exposed

Table I—Tower Design Data

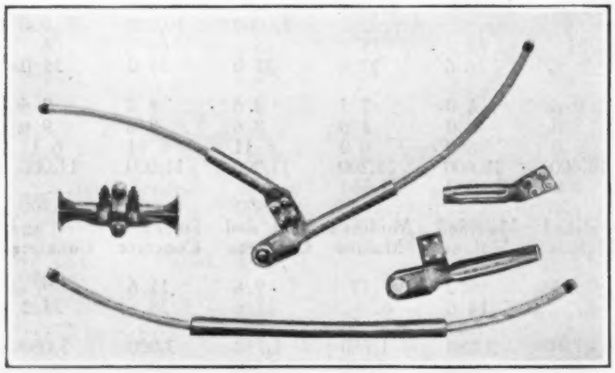
Type of Tower	A	B	B-SA	C	K-ST	K-T	L
Number used	233	43	3	12	2	1	13
Simultaneous test loads, lb.:							
Longitudinal	10,000	12,000	0	16,000	.....	.....	.....
Transverse	8,400	13,000	15,000	22,000	.....	.....	.....
Vertical	14,000	27,000	145,000	27,000	.....	.....	.....
Conductor pull per mast at 0-45 deg. from horizontal	.....	.....	.....	.....	39,000	39,000	39,000
Standard height to hanger support, ft	75	75	75	75	66	66	66
Conductor spacing, ft. and in.	22 7½	26 6	26 6	27 6	35 0	35 0	35 0
Minimum electrical clearances, ft. and in.:							
Live part to structure, normal	7 6	9 6	8 0	7 3	8 6	8 6	9 6
Live part to structure, maximum swing	4 6	5 6	8 0	4 0	8 6	8 6	9 6
Across insulator gap	6 0	6 0	6 0	6 0	6 11	6 11	6 11
Weight of tower without footings, lb.	7,730	16,600	16,600	21,200	11,000	11,000	11,000
Weight of footing steel, lb	560	800	800	1,040	.....	.....	.....
Weight of guys, accessories and footing steel, lb.	.....	.....	.....	.....	5,900	4,800	5,700
Type of footing	Modified Malone	Modified Malone	Modified Malone	Modified Malone	Steel and Concrete	Steel and Concrete	Steel and Concrete
Concrete—Cu.yd. per structure:							
Malone footings	1.6	5.35	9.2	8.15	9.6	11.6	9.
Modified Malone	4.5	5.	14.6	6.	25.6	28.	23.2
Normal span, ft.	1,100	....	....	....	....	....	....
Maximum allowable span, ft.	1,750	1,750	2,200	1,750	1,750	3,000	3,000
Maximum allowable sum of two adjacent spans, ft.	2,700	3,500	4,400	3,500	3,500	6,000	6,000



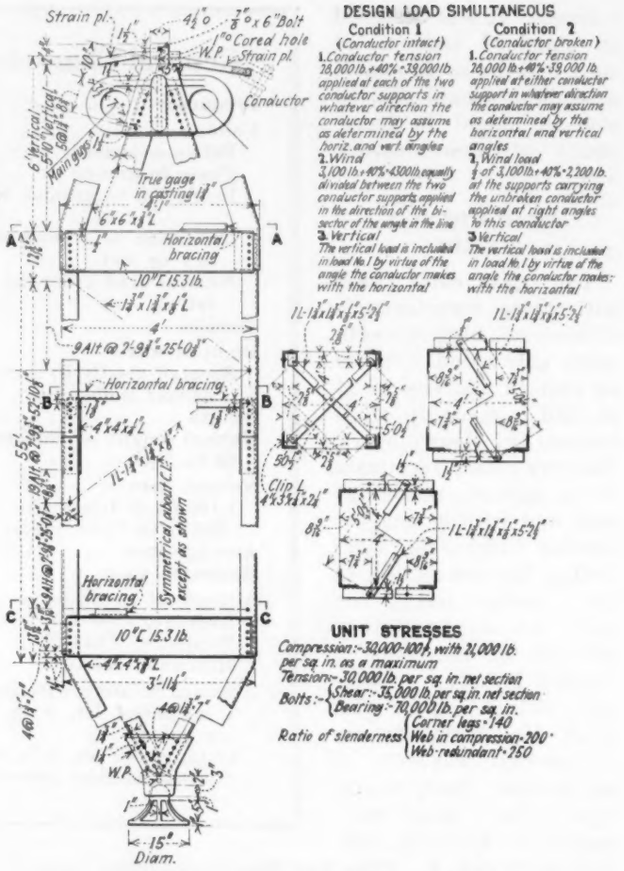
TYPE K STRUCTURE, BASE FOOTING AND GUY ANCHOR



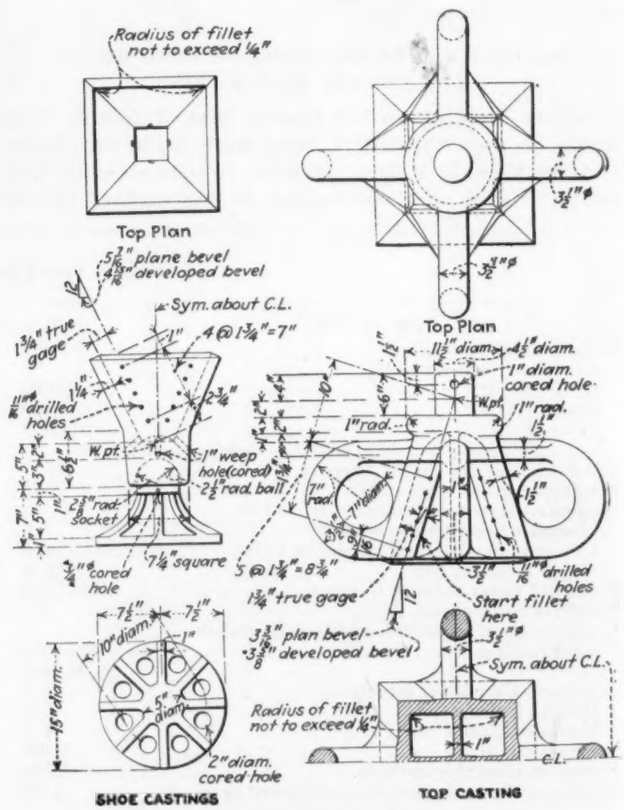
SIDE VIEW OF TYPE B-SA STRUCTURE—SUSPENSION ANCHOR



CONDUCTOR SPLICE, DEAD-END CLAMP AND SUSPENSION CLAMP


Strain pl.
4½"ø
⅞"ø x 6" Bolt
1½"ø Cored hole
W.P.
Strain pl.
Conductor
6" Vertical
5'10" Vertical
5'8½"
Main guys 1¼"
True gage in casting 1¼"
6"x6"x⅞"L
Horizontal bracing
10"℄ 15.3 lb.
1⅜"x1⅜"x⅞"L
4'
9 Alt @ 2'-9⅞" = 25'-0⅜"
Horizontal bracing
4"x4"x¼"L
Symmetrical about C.L. except as shown
Horizontal bracing
10"℄ 15.3 lb.
4"x4"x¼"L
3'-11½"
46@1½"=71"
W.P.
15" Diam.
DESIGN LOAD SIMULTANEOUS
Condition 1 (Conductor intact)
1. Conductor tension 28,000 lb. +40% = 39,000 lb. applied at each of the two conductor supports in whatever direction the conductor may assume as determined by the horiz. and vert. angles
2. Wind 3,100 lb. +40% = 4300 lb. equally divided between the two conductor supports applied in the direction of the bi-sector of the angle in the line
3. Vertical The vertical load is included in load No. 1 by virtue of the angle the conductor makes with the horizontal
Condition 2 (Conductor broken)
1. Conductor tension 28,000 lb. +40% = 39,000 lb. applied at either conductor support in whatever direction the conductor may assume as determined by the horizontal and vertical angles
2. Wind load ½ of 3,100 lb. +40% = 2,200 lb. at the supports carrying the unbroken conductor applied at right angles to this conductor
3. Vertical The vertical load is included in load No. 1 by virtue of the angle the conductor makes with the horizontal
UNIT STRESSES
Compression:- 30,000-100 l/r with 21,000 lb. per sq. in. as a maximum
Tension:- 30,000 lb. per sq. in. net section
Bolts:- Shear:- 35,000 lb. per sq. in. net section
Bearing:- 70,000 lb. per sq. in.
Ratio of slenderness: Corner legs - 140; Web in compression - 200; Web redundant - 250
Clip L 4"x3½"x¼"
1L-1¾"x1¾"x¼"x5'-2½"
1L-1¾"x1¾"x¼"x5'-2½"
1L-1¾"x1¾"x¼"x5'-2½"

TYPE K STRUCTURE—STRUCTURAL DETAILS.



TYPE K STRUCTURE—TOP AND BASE DETAILS

EQUIPMENT FOR PAYING OUT LINE CONDUCTORS FROM THE REELS

held responsible for the accuracy of the foundation work.

Anchors for guys of the angle and dead-end structures were installed in part by the Malone method, but mostly by open excavation and tunneling to insure that the concrete dead man shouldered against undisturbed earth.

Sag Changes and Insulator Deflections

In order to check calculations of insulator deflection and sag changes resulting from unequal sleet loads in adjacent spans, a number of field tests were conducted on a suspension section of completed line. For these tests the spans were loaded with sandbags and observation was made of insulator deflection, sag and tension in the conductor with various combinations of loading. These data were supplemented by observations made when a conductor was tripped in one span, representing a break.

Measurements were made of the impact at the first tower due to the conductor break by inserting a standard dynamometer and an impact dynamometer in series in the insulator string immediately adjacent to the break. The impact dynamometer employed a copper cylinder in compression, the deformation of which was proportional to the tension in the conductor. The results obtained checked closely with the calculations.

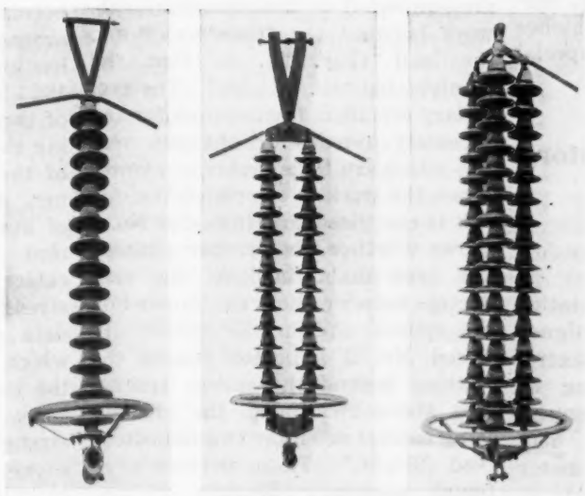
It is of interest that when the conductor was tripped without artificial load the maximum longitudinal pull at the first tower was only approximately 40 per cent greater than the previous steady tension in the conductor of 5,000 lb., but when this steady tension, without artificial load, was raised to 15,000 lb., the similar maximum pull at the tower was only approximately 5 per cent greater.

The displacement of the insulator at the fifth tower from the break was negligible.

Insulators for 220-Kv. Line

Locke Insulator Company, No. 7500
High-strength unit

Dimensions	10 in.x5¼ in.
Listed mechanical strength	18,000 lb.
Weight per unit	12¼ lb.
Single-string suspension fourteen units:	
7,000 lb. maximum load	
Length, including hanger	9 ft. 5 in.
Double-string suspension fourteen units:	
12,000 lb. maximum load	
Length, including hanger	10 ft. 3 in.
Triple-string tension sixteen units:	
18,000 lb. maximum load	
Length of assembly	9 ft. 5¼ in.
Gap from grading ring to horn	5 ft. 11¼ in.



Single string Double string Triple string

SUSPENSION INSULATORS

EQUIPMENT FOR PULLING OUT LINE CONDUCTORS

Central Station and Industrial Practice

Testing D.C. Meters with Alternating Current

BY TESTING different makes of direct-current meters which it uses on alternating current and then rechecking them on direct current, one Middle Western utility company has found that the meters run a certain per cent fast on direct current. By adjusting the meters to run this per cent slow on alternaing current, it found they would be accurate on direct current. Consequently it is testing all direct-current meters up to 50-amp. capacity on alternating current in the laboratory before field installation. Sixty days after installation they are subjected to the customary test with direct current.

Adoption of this practice enables the meter department to utilize its regular alternating-current testing apparatus, including a.c. rotating standards and boards. If direct-current tests were made on these meters, more motor-generator capacity, ammeters, voltmeters and stop watches would be required, as well as special direct-current test boards.

Phase-Rotation Indicator for Portable Use

BY O. L. RIGGS
Underground Foreman Lynn Gas & Electric Company

A CONVENIENT phase-rotation indicator was recently designed by the Lynn (Mass.) Gas & Electric Company for portable testing of overhead and underground connections. It consists of a ¼-hp., 550-volt, three-phase induction motor mounted in a substantial wooden box about 12 in. x 10 in. x 8 in. in over-all dimensions, the motor shaft being provided with a friction-coupled pointer free to rotate between two stops 180 deg. apart, as shown in Fig. 1. Two of these

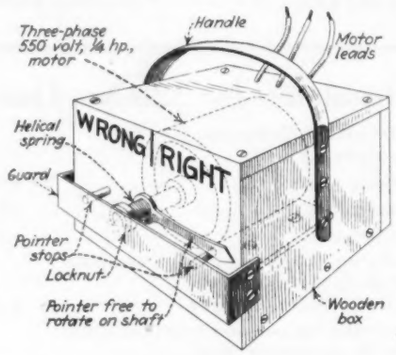


FIG. 1—PERSPECTIVE DRAWING OF PHASE-ROTATION INDICATOR

units are used at a time. The motor will operate equally well on 220-volt, two-phase or three-phase service.

In using the device both indicators are connected to the secondary network between the transformer and the load (Fig. 2), so that the pointers indicate "Right." The secondary circuit is then opened for the necessary repairs or changes, and two joints are taken apart as shown. When the work is completed the circuit is energized, and indicator No. 1 shows whether the proper phasing has been maintained on the conductors between the transformer and the splices. When the splices are closed No. 2 indicator checks the phasing beyond the splices against that above mentioned, the phasing being correct when the two indicators read "Right." These devices were found necessary because of the tendency of customers to leave their equipment connected even when warned of changes in construction, with consequent danger of damage due to wrong rotation.

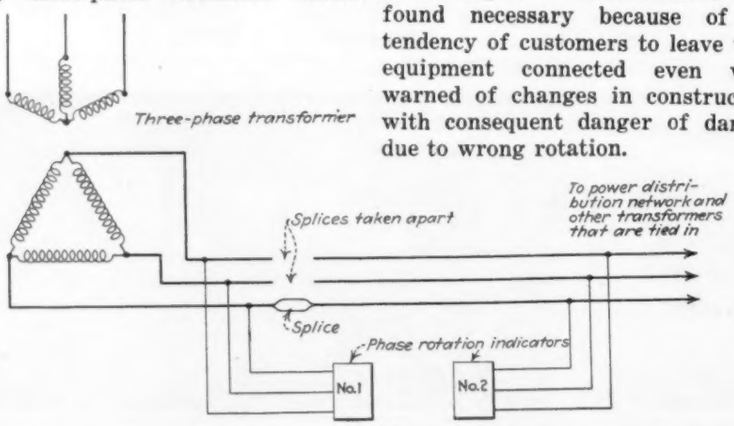


FIG. 2—APPLICATION OF INDICATORS IN MANHOLE TO CHECK PHASING AT JOINTS

Results of Cable Testing

THE more significant data made available through a study of the inspection and test reports of the Electrical Testing Laboratories on a large amount of cable purchased under N.E.L.A. specifications during 1925 and the important conclusions to be deduced from them are briefly as follows:

Of the cable purchased under N.E.L.A. specifications, with or without modification and inspected by Electrical Testing Laboratories, it was found: (1) The percentage of cable that fails to meet the specification has decreased from about 22 in 1923 to about 6 in 1925. (2) Failures to meet the requirements in connection with the bending test decreased from more than 15 per cent in 1923 to less than 1 per cent in 1925. Furthermore, there has been during the same period an increase of more than 50 per cent in the dielectric strength after bending. (3) The dielectric strength of cable under normal conditions as measured by average volt per mill at breakdown has increased about 25 per cent from 1923 to 1925. (4) In tests of samples of three-conductor sector cables during the past three years, 75 per cent of the failures occurred at the corner. An analysis of a limited amount of available data shows, as a whole, that round and sector-conductor cables have the same dielectric strength. (5) A limited amount of data obtained on wood pulp paper which is coming into use shows that the individual tapes have about the same electrical and mechanical strength properties as manila paper, except in folding endurance and carrying strength, where the wood pulp paper is weaker. (6) Cable is supplied on the average with about 5 per cent more lead than is specified and about 10 per cent more insulation. (7) There has been no radical change in the power factor of the dielectric in the last three years.

Of the cable purchased under N.E.L.A. specifications and inspected by Public Service Production Company, a marked improvement was found in the quality of both rubber and paper-insulated cable. Preliminary inspection on bare and rubber-insulated wiring cable is highly desirable. About 15 per cent of the

DISTRIBUTION OF PRINCIPAL FAILURES TO MEET SPECIFICATIONS—PER CENT OF FEET INSPECTED AND TESTED

	1923	1924	1925
Failed, routine voltage test	1.57	1.11	0.26
High or low cable resistance	0.90	0.44	0.39
Low copper area	0.04	0.20	0.14
Low insulation resistance	0.54	0.97	1.29
Thin lead	1.37	1.02	1.35
Thin insulation	0.46	0.15	0.60
Excessive over-all diameter	0.06	0.24	0.56
Short sections	0.25	0.70	0.21
Torn paper in bending test	8.67	3.53	0.15
Defective lead in bending test	5.82	1.90	0.42
Voltage failure in bending test	1.46	0.13	0.02
Miscellaneous	1.41	2.16	0.80
Total	22.55	12.55	6.19

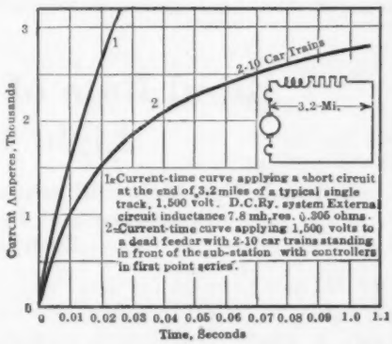
wire was rejected at preliminary inspection before stranding, and about 4.4 per cent of rubber-insulated wire was either rejected or held on the preliminary inspection before braiding. Dielectric strength tests on a small number of samples with manila paper insulation gave results ranging from 320 to 349 volts per mill before bending and 232 to 367 volts per mill after bending. Two wood pulp paper samples tested could not be broken down either before or after bending, because of flashover, but a stress of 465 volts per mill was reached without failure. Two samples of cable with metal sheet conductors showed a dielectric strength of 355 volts per mill both before and after bending.

A summary of the net results of the inspection and tests of 2,250,000 ft. of cable is shown in the accompanying table, with the corresponding figures for the two preceding years.

Operation of Magnetic Type Circuit Breakers

THE magnetic type high-speed circuit breaker for direct-current application employs the principle of a contact arm held in the closed position against a strong spring by a holding armature against the poles of an electromagnet. A tripping coil is interposed between the holding coil and the armature and is so connected that current through this coil exerts a magnetomotive force to reduce the flux in the retaining armature, at the same time increasing the flux through a suitable magnetic bypath circuit without an appreciable change in the flux through the core of the main holding coil. As the tripping current is increased, the flux is shifted in this manner from the holding armature to the magnetic bypass circuit without the necessity of changing the flux interlinking the main holding coil. The effectiveness of this arrangement is such that the armature is released practically instantaneously when current in the trip coil reaches a predetermined value, regardless of the rate at which this current is increasing.

In order to give this type of circuit breaker a discriminating characteristic there is added to it a coil of comparatively high inductance, which is connected in shunt across the terminals of the trip coil. With this arrangement the current divides


Current Amperes, Thousands
Time, Seconds
1
2
2-10 Car Trains
3.2 Mi.
1=Current-time curve applying a short circuit at the end of 3.2 miles of a typical single track, 1,500 volt, D.C.Ry. system External circuit inductance 7.8 mh, res. 0.306 ohms.
2=Current-time curve applying 1,500 volts to a dead feeder with 2-10 car trains standing in front of the sub-station with controllers in first point series.

CURRENT RISE CURVES PRODUCED BY SHORT CIRCUIT AT END OF FEEDER AND FEEDER ENERGIZED WITH LOAD ALREADY ON

between the trip coil itself and the coil of higher inductance that is shunted across it. The division of current between these two coils depends upon the rate at which the current is rising; in other words, and speaking in alternating-current parlance, it depends upon the inclination of the front of the current wave. If the wave front is steep, a larger proportion of the current will flow through the trip coil than would flow if the current rise were slower and with a correspondingly gentler inclination of the wave front.

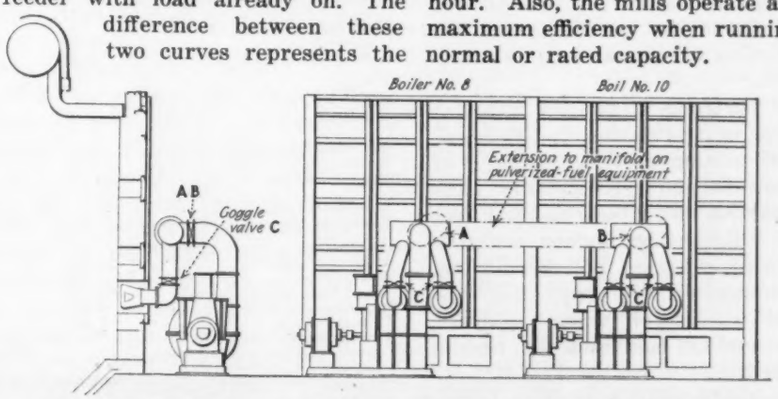
In his paper on high-speed breakers presented at the A.I.E.E. convention at White Sulphur Springs, W. Va., last month, J. W. McNairy presented the accompanying curves showing the difference in rate of current rise caused by applying a short circuit at the distant end of a feeder and energizing a dead feeder with load already on. The difference between these two curves represents the field for discrimination by the circuit breaker; with the current rising very rapidly, as in the case of the short circuit, the trip coil of the breaker receives a larger part of the short-circuit energy than it does in the case represented by the second curve, where the current is rising more slowly and is distributing itself more evenly between the trip coil and the shunt coil on the breaker.

Unit Type Pulverizers for Manifold Operation

GREATER flexibility of operation of two adjacent pulverized fuel-fired boilers in the Mahoningside plant of the Ohio Public Service Company at Warren, Ohio, has been obtained by the installation of a manifold between the two unit type mills. Ordinarily each boiler is served by its own pulverizer, but in the past it was necessary, when either mill was down for repairs, to take the corresponding boiler out of service. This has been obviated by connecting the two mills together as shown by the dotted lines in the accompanying sketch.

Three valves, *A*, *B* and *C*, as shown, were also installed; valve *A* in the powdered coal line from one mill and valve *B* in the powdered coal line from the other mill. Valve *C* is in the burner line from the manifold to the burners. With this arrangement either boiler can be served by either mill. For example, if boiler No. 8 and Mill No. 10 are both out of service, boiler No. 10 can be served by mill No. 8 by opening valve *C* and closing *B*, valve *A* being already open.

Under this arrangement, R. J. Kelly, who devised the installation of the manifold, says, either mill can be used to serve both boilers at ratings as high as 175 per cent, as each mill has a capacity of 6,000 lb. per hour. Also, the mills operate at the maximum efficiency when running at normal or rated capacity.



MANIFOLD BETWEEN UNIT TYPE PULVERIZERS IS SHOWN BY DOTTED LINES

Commercial Activities and Public Relations

Merchant Competition to Stimulate Store Lighting

FINDING that Jewish merchants are more highly competitive than Gentiles as a rule, the sales manager of one electric-service company has capitalized on this characteristic to spread the value of better show-window lighting with very good results.

The method used is to select some Jewish merchants in different lines of activity whose places of business are separated enough so the effect of improved lighting will be evident, but not so far apart that intermediate merchants cannot observe results. The most progressive merchants are not always selected, but rather the "second raters" unless the latter fail to respond to the scheme. Usually it has been found that if one merchant improves his show-window lighting, other near-by merchants will voluntarily do likewise. In one small city where this principle has been applied the average show-window lighting is much above the average of that in other cities of the same size.

After the show-window lighting has been improved the interior lighting will show up by contrast if it has not been simultaneously improved. As a result the show-window lighting competition has created a demand for improved interior lighting.

Public Utility Advertising

THE 1926 edition of 500 representative public utility advertisements selected from 2,000 qualifying advertisements and compiled by the Public Utilities Advertising Association was issued to the industry on June 22 at the convention of the association which was held in Philadelphia.

The portfolio is divided into five sections, central station, institutional, central-station merchandising, gas institutional and merchandising, electric traction and interurban and telephone. Each classification contains a careful selection of meritorious advertising copy — copy that has proved successful when analyzed as to quality, cost and the results obtained.

This collection of advertisements not only is valuable as a reference manual for advertising departments and agencies but it is also a practical handbook for executives to whom campaign and sales plans are brought for final decision. Unacquainted as they are with the technical details of advertising, they can use the portfolio for making comparative analyses or at least they can point out to their advertising managers what they want and how to get it.

Rural Rate of Iowa Railway & Light Company

Schedule Considers and Integrates All Factors of Cost for Each Consumer and Proportions Charges to Each Individually

THE rate here set forth is "applicable to rural electric service from a rural distribution system financed, owned, maintained, and operated by the company, available to rural consumers (owners) who can be served with a transformer of 5 kva., or less, rated capacity." This rate is published complete as an example of the detailed study which is necessary to fix exactly all of the elements which go to make up the cost of rural service.

COST DATA ON STANDARD IOWA RURAL LINE HAVING THREE CUSTOMERS PER MILE

(Figured by W. J. Greene)

The following data are based on a rural line having three customers per mile each served with a 1½-kva. transformer, each consumer having a service line 150 ft. long from connection with distribution line in the highway to the meter loop, and each consumer having a monthly billing demand of 1½ kw.

Investments		
Line	$333.33	
Service line	50.00	
Transformer, lightning arresters, etc.	176.00	
Total investment, exclusive of meter	$559.33	
Charges		
Interest, 7.23 per cent on $559.33	$40.44	
Depreciation, 4 per cent	22.37	
Maintenance, 3 per cent	16.78	
Taxes, 1 per cent	5.59	
Insurance, 0.2 per cent	1.12	
General expense contingencies and profits, 15 per cent on $86.30	12.95	
Core loss costs at 1.8 cents per kilowatt-hour	5.40	
Meters, meter reading, billing, etc.	7.20	
Total		$111.85
Credit for portion of above costs included in demand charge		9.00
Net annual distribution charge		$102.85
Monthly distribution charge		8.57
Monthly demand charge		1.50
Total monthly charge		$10.17
Electricity rate per kilowatt-hour		.029
Data Computed from Rate Sheet		
Meter expenses, etc.	$0.60	
Service line	.75	
Transformer charge	3.10	
Line charge	4.25	
Demand charge	1.50	
Total monthly charge		$10.20
Electricity rate per kilowatt-hour		.029

I—A *monthly charge* made up of the following items:

Item a — Sixty cents to cover the *meter expenses, billing,* etc.

Item b—A *service line charge* of one-half cent per foot of service line measured from the center of the highway, when the rural distribution is located on a highway, or from the said line, when located on a right-of-way owned by the company.

Item c — A *transformer charge* obtained from the following table for the size of the transformer that would be provided if the consumer were to be served by a separate transformer, except that when two or more consumers are served from one transformer and the entire cost of the secondary wiring is covered in the consumers service line charge, the transformer charge for the size of the transformer used shall be apportioned between them by the ratio that the monthly billing demand of each bears to the sum of the monthly billing demands of those served from the transformer:

Size Kva.	Amount
1½	$3.10
3	3.40
5	3.90

Item d—A *pole line charge* determined by multiplying the consumer's monthly billing demand by the value obtained from the Formula A for the demand miles of the line, except that during those months in which the meter, transformer and service line may not be installed, 50 cents per kilowatt of monthly billing demand shall be added to the said pole line charge. If the service line is installed, the amount shall be increased by the amount of the service line charge, item (b).

Formula A—The charge for the demand-miles of a line will be determined as follows:

(1) Obtain the product of 50 cents and the demand-miles of the line.

(2) Obtain the remainder found by subtracting the product (1) from $15.

(3) Divide the remainder (2) by the demand-miles of the line; the quotient is the monthly charge for the demand-miles.

The demand-miles will be the sum of the monthly billing demands of customers served by the line divided by the number of miles of line. The monthly billing demand of a consumer served by the line will be determined as follows:

1 kw. for each rural consumer having no device larger than 750 watts.

1½ kw. for each rural consumer having a device larger than 750 watts but not exceeding 2½ kw.

2 kw. for each rural consumer having a device larger than 2½ kw. but not exceeding 6 kw.

2½ kw. for each rural consumer having a device larger than 6 kw. but not requiring a transformer in excess of 5 kva.

640 watts for each residence consumer, in a settlement or town supplied from the line, having no device larger than 750 watts.

1.7 kw. for each residence consumer, in a settlement or town supplied from the line, having a device larger than 750 watts, but not exceeding 6 kw.

2 kw. for each residence consumer, in a settlement or town supplied from the line, having a device larger than 6 kw. but not requiring a transformer in excess of 5 kva.

85 per cent of the monthly billing demand, based on a kilowatt at 100 per cent power factor, of each commercial light and power consumer, in a settlement or town supplied from the line, who does not require a transformer in excess of 5 kva.

70 per cent of the monthly billing demand based on a kilowatt at 100 per cent power factor of any consumer supplied from the line who requires transformer capacity in excess of 5 kva.

Item e—A *demand charge* as follows:

MONTHLY BILLING DEMAND

	Demand Charge per Month
1 kw. where no device exceeding 750 watts is installed	$1.00
1½ kw. where a device larger than 750 watts but not exceeding 2½ kw. is installed	1.50
2 kw. where a device larger than 2½ kw. but not exceeding 6 kw. is installed	2.00
2½ kw. where a device larger than 6 kw. but not requiring a transformer larger than 5 kva. is installed	2.50

Note — The demand charges and the monthly billing demand as above determined and the monthly billing demands as determined in Item d are tentative values and are subject to revision when authoritative diversity factor data are available.

II. An *electricity base rate* of 2.9 cents per kilowatt-hour for all electricity used in a month.

The *charges and rate* are net. Bills not paid within ten days after rendition shall be increased 10 per cent on the first $10 and 2 per cent on amounts in excess of the first $10. The electricity base rate will be increased or decreased, beginning with each fiscal year, at the rate of one mill per kilowatt-hour for each 50 cents (or major part thereof) variation in the energy cost per ton from a base energy cost of $4.50 per ton of 10,000 B.t.u. fuel burned during the previous fiscal year. The energy cost per ton of fuel burned shall be obtained by dividing the total fuel, boiler room labor and water (for boilers) expenses by the number of tons of fuel burned in the company's steam electric plants. A fiscal year is the period from April 1 to March 31. Should the quality of the fuel burned vary from 10,000 B.t.u., the base energy cost shall be varied in proportion as the fuel burned varies from 10,000 B.t.u.

"Spare Battery" Exchange Rate in Hartford

TO ENCOURAGE the larger use of electric trucks in the territory of the Hartford (Conn.) Electric Light Company, the Electric Transportation Company, Inc., of Hartford, has recently adopted a spare battery exchange rate with several interesting provisions. Under this rate the customer purchases from the Electric Transportation Company one Ironclad Exide battery with each truck, and if operation under this service is continued, is required to purchase one renewal for his battery at the termination of each four-year period from the date the original battery was purchased. Although the life of the Ironclad Exide is fixed at from three to three and one-half years in ordinary service, the Electric Transportation Company is able to guarantee the life of the customer's battery for four years under this service because of the spare batteries used and the expert care given batteries.

The service rate on the spare battery exchange system applies only to new trucks purchased from the Electric Transportation Company complete with batteries before Dec. 31, 1926. In consideration of the purchase of the battery by the truck user, the fixed and mileage charges are both reduced below the regular battery exchange service rates as follows:

	Truck Size			
	1-Ton	2-Ton	3.5-Ton	5-Ton
Fixed Charge per Year:				
Regular battery service	$570	$670	$770	$870
"Spare" battery service	300	500	600	700
Mileage Charge:				
Regular battery service	0.06	0.09	0.13	0.15
"Spare" battery service	.04	.06	.08	.09

In each case the fixed charge is under a yearly contract and the mileage charge is billed monthly. There is also in each rate an ampere-hour adjustment by which the monthly mileage bill is subject to decrease or increase at the rate of 0.8 cent for each ampere-hour used below or above the following basic ampere-hours per mile: one-ton, 6; two-ton, 8; three-ton, 10; five-ton, 12.

After four years the transportation company agrees to give back the battery to the customer if desired and if it is still in use, or to make an allowance to the customer provided the truck continues operation under this service equal to the turn-in value of the old battery as established by the manufacturer at that date. In the event that the customer's truck is idle, the Electric Transportation Company continues its obligations as regards the care, maintenance and life of the battery, provided the battery in the truck is delivered to the company within six days of the layoff. The transportation company agrees to maintain the battery free of charge under these

ELECTRIC TRUCK SERVICE BILLBOARD MARKS BUSY CORNER

conditions and reserves the right to use it in other trucks. When the battery is so used the customer is allowed a credit of one-half the fixed yearly charge, determined by the ratio of the number of days so used to 365 days.

The customer may withdraw from the service at any time by giving written notice, pro rata adjustments being made on the fixed yearly charge.

At present 73 electric trucks are operated through the garage of the transportation company, 57 of which are on battery exchange service. The present service totals about 40,000 miles per month, and about 100,000 kw.-hr. per month is taken by the garage, which is located at 380 Sheldon Street, about three-quarters of a mile from the business center of Hartford. The company sells both "Walker" and "Commercial" trucks and has adopted a trademark illustrating electrified horsepower, shown in the accompanying reproduction from its letterhead. W. M. Thayer is president.

Eliminating the Irritation from Public Inconveniences

VARIOUS things have to be done by a public utility, such as tearing up streets for conduits, remodeling offices, etc., that inconvenience and often irritate the public because people do not stop to think that these operations are signs of progress and always for their own benefit. Recognizing this fact and seeking to make all its relations with the public as pleasing as possible, the Consumers Power Company of Michigan apologizes for every public inconvenience and simultaneously emphasizes or infers what benefit the work will eventually bring to the public.

One of the most recent applications of this idea is the sign erected at a conspicuous corner of the site of its new eleven-story, $800,000 office building in Jackson, Mich., a city of about 7,000 population. It was erected, despite the fact that this building is the most attractive addition to the city's business district, because it was necessary to build a protected area along the sidewalk that obstructed traffic somewhat.

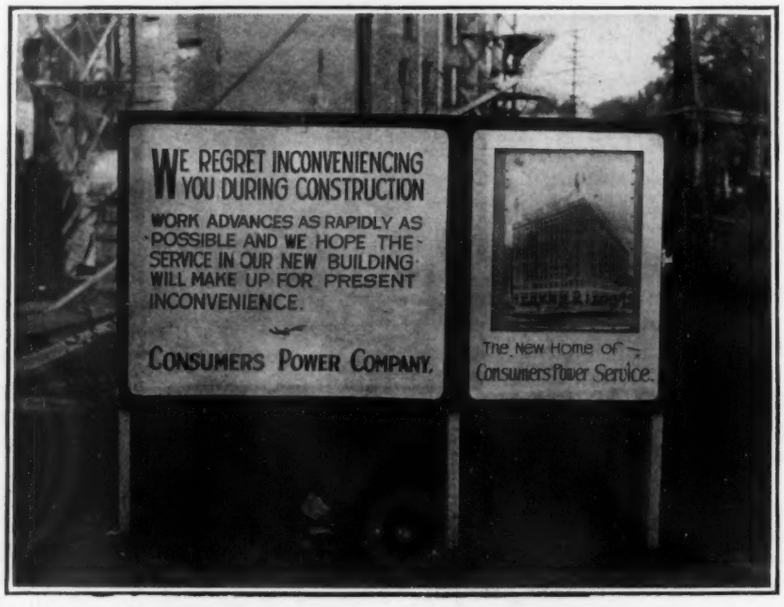
The value of such little evidences of courteous consideration are sometimes discounted by utilities, because they believe the public takes no notice of them. However, the accompanying editorial from the Jackson *Citizen-Patriot* — the leading local paper—indicates that the utility attitude was appreciated.

Consumers Power People Always Courteous

Would that there were more as courteous as is the Consumers Power Company. Under any and all circumstances and conditions, the C.-P. maintains its civility and politeness—even in the stress and turmoil of constructing its mammoth eleven-story building. It is a new and pleasing innovation in Jackson to see a great corporation apologizing for having to block the sidewalk while erecting huge buildings, but alongside a large cut of the new office building may be seen this unheard of notice to the public:

> "We regret to inconvenience you during the process of construction. Work is advancing as rapidly as possible, and we hope the service in our new building will make up for the present inconvenience."

Now, isn't that nice! If our motor car drivers were as courteous as this there would be little fear of serious accidents. But I am dead sure that the public will not be inconvenienced by the construction of the Consumers Power Company's mammoth building. On the reverse, it welcomes the obstruction created by the building of the $800,000 structure, and it applauds the company for the progress it is making.—Jackson *Citizen-Patriot*, June 6, 1926.


WE REGRET INCONVENIENCING YOU DURING CONSTRUCTION
WORK ADVANCES AS RAPIDLY AS POSSIBLE AND WE HOPE THE SERVICE IN OUR NEW BUILDING WILL MAKE UP FOR PRESENT INCONVENIENCE.
CONSUMERS POWER COMPANY
The New Home of Consumers Power Service

A SIGN THAT TURNS IRRITATION INTO APPRECIATION
Bulletin erected by Consumers Power Company at site of new office building construction because sidewalk was obstructed.

Salesmen Assigned to Collections Occasionally

FOR at least two reasons salesmen of the Central Illinois Public Service Company are occasionally loaned to the collection department, according to C. O. Dunten, commercial manager. One reason is that Mr. Dunten sincerely believes in co-operation with other departments for the teamwork it encourages and the appreciation it develops. The other reason is that a salesman quickly learns in collection work what practices to avoid in sales work. Furthermore, the expectation of being delegated at any time to collection work makes a salesman sell with more thought to whether the customer will be permanently or only temporarily satisfied.

Canadian Customer Ownership Goes Over Big

A SUCCESSFUL customer-ownership campaign has just been concluded by the Northwestern Utilities, Limited, which supplies the city of Edmonton, Alta., with natural gas service for light, heat and power purposes. A team of 50 employees sought to place with consumers a block of $100,000 cumulative prior preference 6 per cent shares at 92 to yield 6½ per cent as an investment. A ten-day selling campaign was planned, but in three days the original allotment had been placed and it was continued for eight days, when approximately $151,000 was sold, the average sales of each employee being approximately $3,000.

Digest of Electrical Literature

Generation, Control, Switching and Protection

28,866-Kva., 220,000-Volt Transformers for Pennsylvania Power & Light Company.—F. F. BRAND.—That the transformer designer's art is capable of meeting the present demands for transformers to carry the total power transmitted over a 220-kv. line is shown by the completion of what are believed to be the largest single-phase transformers in the world with respect to voltage and kilovolt-ampere rating. These transformers have a rating at 60 cycles of 28,866 kva., transform from 220 kv. to 66/11 kv. and are connected in Y on the 220-kv. and 66-kv. circuits. The rating of the bank is, therefore, 86,600 kva. In reality these transformers are larger than their kilovolt-ampere rating indicates, as they are three-circuit transformers—the capacity of the various windings being as follows: 25,000 kva. at 127,000/220,000 Y volts, 28,866 kva. at 38,100/66,000 Y volts, 20,000 kva. at 11,000 volts. The 11-kv. windings are used with synchronous condensers which correct the power factor of the load and provide the desired voltage regulation. The transformers were shipped, oil-filled, to their destination in special container tanks on drop-frame cars and transferred to their own tanks on arrival.—*General Electric Review*, July, 1926.

Transmission, Substations and Distribution

Transmission Systems of France.—J. SORDE.—Data collected from the latest French electrical census have been recorded on a two-color map drawn on the scale of 1 to 625,000 and showing all lines rated at 30,000 volts or higher. The map was prepared by the Société Financière pour le Développement de l'Electricité and should be of more than national interest. A total of 120 generating stations with their transmission and distribution lines are indicated on this 65-in. x 65-in. map.—*Revue Générale de l'Electricité*, May 29, 1926.

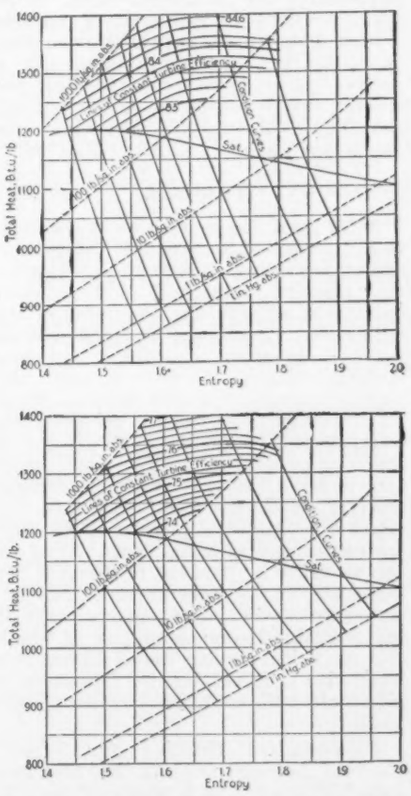
Energy Losses in Steel-Aluminum Cables.—P. WEIDIG.—The opinion has been expressed that combination steel-aluminum cables have higher losses when carrying alternating current than when they carry direct current. The reason given was the length-magnetizing of the steel core, due to the twist of the aluminum wires around it. At the laboratories of the Dresden University careful tests were made to investigate this opinion. Four cables, each approximately 300 ft. long, were measured, as follows:

Ratio Al/Cu	Cross Section Al	Over-All Diameter
(1) 6:1	166 mm²	18.2 mm
(2) 4:1	106 mm²	15.0 mm
(3) 3:1	150 mm²	18.5 mm
(4) Pure copper cable for stock...		12.5 mm

Cables (1) and (3) showed noticeably higher losses for alternating current, while cable (2) had up to 1.23 times higher losses for alternating current than for direct current. It is explained that the two layers of aluminun wires of cables (1) and (3) were twisted oppositely, while cable (2) had both layers of aluminum twisted in the same direction. In the former two cables the length magnetization was largely compensated. It is therefore suggested to build combination steel-aluminum cables always in such a way that the two outer layers of aluminum will be wound on the steel core in opposing ways. Such a cable will show only 1.005 to 1.092 times more loss for alternating current than for direct current. — *Elektrotechnische Zeitschrift*, April 29, 1926.

Hydro-Electric Development and Steam Equipment

Notes on Comparison of Steam-Turbine Efficiencies.—E. L. ROBINSON.—There are certain fundamental relations between stage efficiency, reheat factor, turbine efficiency, cycle efficiency



CONDITION CURVES FOR 70 AND 80 PER CENT CONSTANT STAGE EFFICIENCIES AND AN INFINITE NUMBER OF STAGES

and thermal efficiency which by means of certain definitions may be confined wholly to the properties of expanding steam. Charting of the various values shows that many effects are so nearly negligible that the relations become simple and easy to handle both for the Rankine cycle and for the extraction cycle. It is the purpose of this article to show how the supposition of an equivalent uniform stage efficiency permits its quick determination under any particular set of conditions.—*General Electric Review*, July, 1926.

Units, Measurements and Instruments

Heat-Balance in Solid Insulators.—K. BERGER.—Theoretical and practical investigations, carried on during the last few years, have shown that dielectric losses in solid insulators may lead to a puncture when the operating voltage is high. The cause of the failure is the internal heating of the insulator due to these losses. The losses rise with increasing temperature, so that under certain circumstances no balance can be reached between losses and generated heat and the dissipated heat. Losses and heat will raise each other indefinitely, until the insulator punctures. Based upon exhaustive tests made in a Swiss laboratory on many insulating materials, the author gives in this theoretical paper an explanation of the influence of heat on the dielectric materials used in cables, giving curves from which the highest permissible operating voltage can be computed for a cable of any chosen characteristics.—*Electrotechnische Zeitschrift*, June 10, 1926.

Illumination

Studies in the Projection of Light.—Part XX.—FRANK BENFORD.—A continuation of light projection research reports. After the searchlight source and mirror have been combined optically there yet remain several factors that must co-operate with the main theory to make the projection a success. The problem of the glass door is one of these important considerations and is here the subject of careful and thorough analysis.—*General Electric Review*, July, 1926.

Motors and Control

New Methods of Improving the Synchronizing Torque and Weight Efficiency of Synchronous Induction Motors.—VALERE A. FYNN.—Polyphase self-excited synchronous induction motors are analyzed with special reference to weight efficiency, conversion efficiency and configuration of synchronizing torque. It is shown that the weight efficiency of such machines is low compared with that of polyphase asynchronous motors, because the secondary must be designed to carry polyphase load currents as well as unidirectional load and exciting currents. The alternating currents must be carried in polyphase winding, the unidirectional currents in a single-phase winding. Although the latter may be a part of the former, it nevertheless follows that it is virtually impossible to make the maximum synchronous torque of a given frame equal to the maximum asynchronous torque of the same frame. To overcome these drawbacks the author has conceived the idea of providing self-excited synchronous induction motors with a constant synchronizing torque, to run the machines synchronously from no load to a little beyond full load, and to run them asynchronously for all higher loads. The man-

ner in which a constant synchronizing torque is produced is explained in detail, and it is shown how the somewhat conflicting requirements of synchronizing torque and acceptable compounding characteristic may be harmonized.—*Journal of Institution of Electrical Engineers (England)*, May, 1926.

Heat Applications and Material Handling

Resistance Furnaces.—The types of furnaces covered by this classification include those for high-temperature hardening, carbonizing, annealing and other forms of heat treatment. Summarizing the points of advantage as experienced by users of such electrically heated equipment: Repairs are less, owing to the linings of the furnaces not being subject to excessive temperatures. Operating labor costs are less per ton than in the case of solid fuel. The time required for heating furnaces up to working temperatures is less. Rejection of material is less except in some instances. The product is more uniform owing to accurate control of temperatures. The construction is more adaptable to automatic operation of the furnace. Increased electric load factor makes cheaper electric power cost. Furnaces used in off hours are given power at low price. The cost of energy is generally less than the cost of solid fuel. Scaling and decarbonizing do take place in work if great care is not exercised. The comfort of the operators is much greater where no fumes are to be experienced, and in dealing with furnace problems one cannot overlook the viewpoint of the operator. The comment of a foreman of a shop in which electric furnaces had been installed some time previous was: "These men have had a nice, clean, comfortable job so long and get their work out with so little trouble that if we were to go back to the old fuel-fired furnaces, I believe they would quit their jobs."—*Iron and Steel Engineer*, June, 1926.

Electrophysics, Electrochemistry and Batteries

Testing Corrosion of Iron.—T. FUJIHARA.—According to the electrolytic theory of corrosion, the initial corrosion of iron is due primarily to an attack of hydrogen ion on the metal. This originates between the metal and an inclusion, forming a set of galvanic cells in which the metal is electro-positive to the inclusion. In order to test out this effect of inclusion upon corrodibility of iron, the author has discovered a corrosive mixture in which various kinds of iron in respect to purity can be successfully differentiated. The mixture consists of equal parts of distilled water and ethyl alcohol. In testing specimens of iron with this mixture the author used three specimens — electrolytic iron melted in vacuo, "Armco" iron and wrought iron—each of which was placed for several days in a test tube containing the mixture. The results showed that wrought iron corroded most, "Armco" iron next and the electrolytic iron least. The foregoing experimental work was conducted in Dr. A. Sauveur's laboratory, Harvard University. —*Chemical and Metallurgical Engineering*, June, 1926.

Telegraphy, Telephony, Radio and Signals

Radio Picture Transmission. — F. SCHRÖTER.—A new process of transmitting line drawings or photographs over wires or by radio is described in this paper. Judging from the six reproduced samples, this process is much superior to the method used by American concerns. The perfect results obtained are ascribed to a highly efficient photo-electric cell and a receiving apparatus free from inertia. The former is a potassium cell in a toroid-shaped glass bulb which reacts on reflected light instead of light passing through a transparency. The receiving element is a Kerr cell, based upon the hitherto not utilized physical fact that polarized light passing through nitro-benzol between electrically charged condenser electrodes suffers a double refraction, the degree of which is influenced by the electric charge. The photo-electric cell responds to frequencies as high as 10^5 cycles, while the Kerr receiver does not lag appreciably for 10^8 cycles. It is, therefore, possible to transmit a picture 4 in. x 4 in. in size within five seconds. It is further possible to transmit a motion picture with ten frames per second, which makes television readily possible. — *Zeitschrift des Vereines Deutscher Ingenieure*, May 29, 1926.

Traction

Main Road Electrification in Austria.—P. DITTES.—This paper is the annual report recording the progress made on the officially approved general electrification of all the Austrian main railroads. Completely finished and in regular schedule operation are the Arlberg line (85 miles) and the Salzkammergut line (68 miles). Work is at present in progress on the lines east of Innsbruck up to Salzburg, a distance of 190 miles. The report goes into great detail describing the hydro-electric power stations supplying the roads, giving data concerning the hydraulic and electric parts. Most of the installed apparatus is directly for 16⅔-cycle single-phase current. Several pages are devoted to the description of the available locomotive types, of which the most interesting model is the engine with four vertical shaft motors.—*Elektrotechnik und Maschinenbau*, May, 1926.

Regenerative Braking for Direct-Current Locomotives.—A. BREDENBERG, JR.—This paper is a study of several direct-current regenerative braking systems now in operation. The general characteristics of regenerative braking, including advantages, limitations and functions, are briefly discussed. The principal points covered in the descriptions of the various systems are methods of field excitation during regeneration, compensation for sudden changes in line voltage or grade, method of control, operating characteristics and relative complication of equipment. A comparison is made of two methods of field excitation, based on a six-motor, two-speed, 3,000-volt locomotive. Curves are included, illustrating the feed-braking characteristics and also the motoring characteristics. The conclusions drawn from this comparison are that, in general, the separate excitation system is to be preferred on account of the greater braking effort and better speed range provided. Since the motor excitation system can be provided with less additional expense, it is desirable to consider this method when the expense of the separate excitation system does not seem justifiable.—*Journal of A.I.E.E.*, July, 1926.

Miscellaneous

Recent Developments in Electro-Farming.—This is an abstract from a paper read by R. Borlase Matthews before the Institution of Electrical Engineers in England describing present practices in farm electrification and discussing future possibilities. — *Electrical Engineer of Australia and New Zealand*, May, 1926.

Non-Destructive Testing of Wire Hoisting Rope by Magnetic Analysis.—R. L. SANFORD.—In an endeavor to meet the great need for a reliable non-destructive method for the testing of wire hoisting rope, the Bureau of Standards has conducted an investigation of the possibilities of magnetic analysis for this purpose. The investigation has been of a fundamental nature, consisting in a study of the magnetic properties of steel wire of the kind used in the manufacture of wire rope and the effect on them of deterioration due to various causes. The effects of stress, wear and fatigue were studied. Although the investigation did not result in the development of a magnetic device for testing wire hoisting rope, certain definite results were obtained which have an important bearing not only on this problem but also on the general subject of magnetic analysis.—*Bulletin No. 325, Department of Commerce, Washington.*

Rural Electrification in Virginia.—J. A. WALLER. — A report prepared from a study by field investigation and questionnaires under the direction of the Virginia Committee on the Relation of Electricity to Agriculture and, particularly, Charles E. Seitz, head of the department of agricultural engineering, Virginia Polytechnic Institute. A survey is made of the whole state and maps are presented showing by districts the rural lines now in service and the number of farms served. Some interesting comparative costs of lines are given for the various districts. The maximum cost per mile for a single-phase line in any district is given as $986.96, and the maximum average cost of a three-phase line in any district is given as $1,625. Cost figures also include average initial power and lighting and minimum rates in various parts of the state. A large number of visits to various types of farms were made and a great deal of statistical information was gathered, particularly as to the number of appliances in use and the average and total kilowatt-hour consumption per farm per month in the various districts.—*Bulletin of the Virginia Committee on the Relation of Electricity to Agriculture.*

News of the Industry

Agreement on Rate for Wilson Dam Power

Army Engineers and Alabama Power Company Finally Reach Common Ground

AFTER more than a week's negotiations representatives of the Corps of Engineers and of the Alabama Power Company reached an agreement as to a new schedule of charges for power developed at the Wilson Dam. The rates agreed upon are:

When substituted for Gorgas steam power, 2 mills per kilowatt-hour.
When substituted for Gadsden steam power, 3 mills per kilowatt-hour.
When substituted for Sheffield steam power, 4 mills per kilowatt-hour.

The agreement is to continue without restriction until Dec. 1. After that date it may be terminated by either party to the understanding upon 30 days' notice. A statement given out at the Corps of Engineers reads as follows:

"The rates proposed by the Engineer Department and rejected by the Alabama Power Company were based on the market price of coal.

"The Alabama Power Company has permitted the department to examine its cost records of operation, of its steam plants and its coal mines.

"The power company has expanded its mining operations and is prepared to supply the coal requirements of its own and leased steam stations.

"This makes it necessary to figure the saving to the company through the use of hydro power from Wilson Dam on the basis of the mining cost of coal in the company's mines, plus freight. On this basis the rates arrived at are believed, by the department, to be fair, both to the government and to the power company.

"In order to encourage a maximum use of hydro power, it is provided that power transmitted or relayed to other public utility power companies will be charged at the 2 mills per kilowatt-hour rate. The power company agrees to use the available hydro power at Wilson Dam to a maximum in replacement of steam and that it normally will not operate its steam plants when Wilson Dam power is available, except as may be necessary for voltage regulation, protection of its customers and any cause of breakdowns or line interruptions until the Wilson Dam plant is carrying a minimum of 80,000 kw.

"Under the original agreement the government received $119,000 from the Alabama Power Company for the sale of power generated at Muscle Shoals for the month of June, 1926. If the new contract had been in effect the government would have received $145,000 for this power."

The consummation of this agreement allowed the immediate resumption of the export of 20,000 kw. to the Carolinas. This delivery of power had been cut off since July 3. It also puts the Alabama Power Company in a position greatly to increase its exports of power both to the northeast and to its interconnected system in Mississippi. While the line capacity from Muscle Shoals is limited to 85,000 kw., an additional 80,000 kw. can be developed at the Gorgas and Gadsden steam plants in case there should be a demand for more power.

Under the present arrangement little use is likely to be made of the Sheffield steam plant. It would only be used in the case of very low water or generator trouble. The generators at the dam are still under test. Rewinding has been necessary on certain of the units.

Twentieth Anniversary Convention of I.E.S.

Marking the founding of the society in 1906, the twentieth anniversary convention of the Illuminating Engineering Society is to be held at Spring Lake, N. J., from Sept. 7 to 10 inclusive, with headquarters at the Essex and Sussex Hotel. A program of diversified and comprehensive papers has been arranged, including subjects of great practical interest. A special feature will be a session devoted to developments in the art of illumination which have taken place during the twenty years of existence of the society. Another session will be devoted to the presentation and discussion of the "Lighting Sales Manual," prepared by a joint committee of the Illuminating Engineering Society and the National Electric Light Association. The manual outlines methods found by leading illuminating engineers to have been the most efficient in promoting good lighting by central stations.

At still another session, under the auspices of the committee on natural lighting, there will be a series of practical papers covering a variety of subjects such as the effect on illumination of dirt accumulation on glass, distribution characteristics of various types of glass, natural lighting in schools and the relative effectiveness of various methods of light control through windows. The entertainment features of the program have not been overlooked, and there will be golf, bathing, tennis, horseback riding and motoring in abundance.

Charles A. Coffin Mourned by Industry

His Associates and Friends of Long Standing Recount His Accomplishments and Give an Intimate Glimpse of His Business Career and Human Qualities

CHARLES A. COFFIN, founder of the General Electric Company and for 30 years its inspiration and leader, was laid to rest on Saturday afternoon, July 17, 1926, in Locust Valley Cemetery. More than a hundred men prominent in the electrical industry and associated with Mr. Coffin in business life journeyed by special train and automobile to the Coffin estate at Locust Valley, L. I., to pay their last respects to the great leader.

There was no eulogy, no outward demonstration, just the quiet and calm of a secluded country estate in one of nature's finest settings and the simple and dignified burial service of the Episcopal Church. The same absence of ostentation and show which characterized Mr. Coffin throughout his life marked his funeral. He died, as he lived, simply, sweetly and greatly beloved.

A biographical sketch of C. A. Coffin and an account of his death were published in the ELECTRICAL WORLD, July 17. Since then and at the request of the ELECTRICAL WORLD many of Mr. Coffin's friends and associates have contributed more intimate sketches of him and indicated how great a loss the electrical industry has sustained by his death. Naturally these impressions and estimates are not always the same, but they all agree in paying tribute to the high character of Mr. Coffin as a business man, to his genius and vision in making the General Electric Company the largest and most influential company of its kind in the world, and to his unremitting aid and encouragement to the cause of electric light and electric traction. The tributes are given herewith.

Contributed to Wealth of Nation

I REGRET to learn of the death of my respected friend Charles A. Coffin. He was the most remarkable business man I have ever known. In fact, to my mind, he was one of the greatest among the men who have so greatly contributed to the surprising increase in the wealth and prosperity of the United States.

Orange, N. J. THOMAS A. EDISON.

Industry's Greatest Organizing Genius

THE death of Charles A. Coffin, the founder of the General Electric Company, takes from the electrical industry in America its greatest organizing genius. What Mr. Edison is to electrical invention Mr. Coffin was to electrical business. His greatest gift was to inspire human beings and to bring out the best there was in every man

with whom he came in contact. He had early the vision of what electricity might do and he had unequaled courage in the formulation and execution of a business program.

During and since the war Mr. Coffin's greatest effort had been given to the organization and aid of helpful enterprises in varied fields. He created the War Relief Clearing House. He aided in establishing American scholarships for France. He was a supporter and sympathetic worker for many colleges and was greatly interested in the development of students' loan funds.

It was his invariable custom to avoid all personal publicity, and in that effort he endeavored to prevent the use of his name in connection with his contributions both of service and of money. Only those who were intimately associated with him knew of his untiring work and the wide range of his financial aid. More than one hundred institutions of service will miss his inspiration and his efforts in their behalf. He was a lover of books and flowers as well as of men, and his life in every relationship exemplified the things for which we should wish our leaders in America to stand. OWEN D. YOUNG.

New York City.

His Work Will Live After Him

MR. COFFIN'S work will live after him and his name will not be forgotten. For those of us who for many years have reckoned him as a friend there will be an empty place in our lives. ALEX DOW.

Detroit, Mich.

His Sun Has Gone Down While It Is Yet Day

MEN are great as they rise to great occasions. Through the time and chance of electrical development in America Charles Albert Coffin came to the presidency of the General Electric Company just when electricity was destined to play a new part in industrial and home life. Never before had one man taken such a major part in this field. He was not an inventor, but a human dynamo in the business and financing of electrical development. We in the electrical business are as yet too near to his presidency to appreciate truly his genius. When the history of American electricity is fully written his name will occupy a distinguished place. Mr. Coffin brought together the several manufacturing companies until today but two great electrical organizations exist in America. He cemented the ties that enabled the General Electric to girdle the globe.

The first time I met Mr. Coffin was in Boston in 1890. He was then president of the Thomson-Houston Company, and from that first meeting blossomed a friendship which lasted until his passing. He was a modest man. He never sought the laurels now being bestowed upon his memory. He never sought credit for his remarkable achievements. His was a humble life. That was the way I found him ever and always. Mr. Coffin builded the foundation of the electric power structure that we stand on today. His death recalls the words of the prophet Jeremiah as he looked down on the doomed city of his love and said, "Her sun is gone down while it is yet day," and Mr. Coffin's "sun has gone down while it is yet day." I mourn the loss of my friend and am profoundly grieved by the death of Charles Albert Coffin. CHARLES R. HUNTLEY.

Buffalo, N. Y.

A Dear Friend

I AM deeply grieved to hear the sad news of the death of a dear friend. His passing creates a condition in our industry similar to that which exists when death removes the head of the family and the children have then to carry on without the kindly guidance and watchful eye of the father.

SAMUEL FERGUSON.

Hartford, Conn.

Pre-eminently Successful as Organizer and Executive

ALL MUST regret the death of Charles A. Coffin and review his career with definite feelings of gratitude and admiration.

It would be hard to overstate the importance of the part he played in the development of that notable portion of the electrical industry which deals with light, heat, power and transportation, the growth of which industry is one of the marvels of our times.

In 1882, when Mr. Coffin first came in touch with that industry by participating in the organization of the Thomson-Houston Electric Company, there was no electric transportation and no distribution for power purposes or for general household use. There were only a few arc lighting plants and the beginnings of the Edison system of incandescent lighting.

Mr. Coffin had no technical education and only that business and industrial training which he had acquired in his work as a successful shoe manufacturer. But he had not only marked business ability but general capacity of a high order. Even as a shoe manufacturer he had been conspicuous for the intelligence and originality of his methods.

For a time he was not in executive control of the Thomson-Houston company, although active in its management. But he studied the situation and soon became enthusiastic as to the future of the electrical business. Surely no one could then have realized the magnitude of the field or the marvelous development which was to come in such a relatively short period. But Mr. Coffin was one of the few who foresaw with the utmost clearness that applied electricity was destined to play a great part in the service of man. Finally, with great hesitation, he decided to give up his career as a shoe manufacturer and devote his energy to this new art. From that time he never wavered in his enthusiasm and his belief in the future of electricity as applied in the arts.

The early years were filled with difficulties and disappointments. The business was new and presented problems which were substantially without precedent and which required new business methods. People generally did not at all appreciate the need or the value of electricity. They had to be educated to its use even in what has since proved to be the relatively narrow field of electric lighting. Electrical apparatus and devices, as well as the methods for using the same and the steam plant in connection with which they operated, were to the last degree crude. They were practically only in an experimental stage. Suitable manufacturing methods as well as adequate ways of distributing the manufactured product had to be devised. The financial risk and the cost of an electric installation, involving as it did not only the electrical apparatus but real estate, steam plant and elaborate wiring, were so great that there were few who had the courage and the necessary capital to buy and install such apparatus for such use in a new and unexplored field. Customers did not exist; they had to be created. The whole matter was enormously complicated by the conditions of competition and by the existence of a serious patent problem due to the fact that the new art was based upon an infinite number of inventions, the numerous patents on which were owned by many different concerns. No manufacturer could build apparatus without danger of patent infringement.

Those who remember the condition of the electrical industry at the time of the panic of 1893 realize how difficult and serious was the situation.

In dealing with these problems and many others, Mr. Coffin showed extraordinary capacity, great insight and an imaginative power of high order. Throughout his career his persistency, resourcefulness and admirable temper, in the face of most difficult conditions, were worthy of all praise. On the technical side of his work he had the benefit of the co-operation of such men as Prof. Elihu Thomson and E. W. Rice, Jr. On the commercial and financial side he had competent and loyal assistants. But he himself gave character and unity to the joint work of himself and his associates and it was his qualities of leadership that were reflected in the marked enthusiasm with which he inspired his organization. He was, personally, to an unusual degree, responsible not only for general policies but for the special forms in which those policies were worked out. A single example will indicate the originality and practical efficiency of his methods:

A most serious problem was that of attracting investors so that they would contribute the large amount of capital necessary for the establishment of plants which should be established that there might be customers for his manufacturing company. To this subject Mr. Coffin gave much thought and attention. Many and notable were the expedients devised by him to accomplish this result.

Among other things, in 1890 he created the first corporation, not itself a manufacturer or user of electrical apparatus, the business of which was to acquire bonds and stocks of operating electric public service companies and to issue its own securities, fundamentally based upon the securities of the operating companies, for sale to investors. The company acquiring the securities of the operating companies and issuing its own securities for sale to the

public was in a position carefully to study the situation and to limit its investments to operating companies which were likely to succeed. By this plan danger of loss was reduced, because the securities sold to the public were based upon many properties and did not depend upon the success of a single plant. If the company issuing the securities to the public could gain the confidence of investors by satisfying them that it was careful in the selection of the underlying securities it would be in a position to attract capital to an unlimited extent. In this way funds would be provided for the development of the operating companies and a market established for the output of the manufacturing companies. The plan was pre-eminently successful.

This method of large scale financing, which originated with Mr. Coffin, has played a notable part in the development of the electrical industry.

Reference has been made to the fact that in the early days of the industry the patent situation was a matter of serious embarrassment. This was due to the fact that, because the art was new and rapidly developing, each of the competing manufacturing companies owned patents for inventions which could not be lawfully used by the others and many of these patents were essential to the production of satisfactory apparatus. Such a situation was intolerable for the public as well as for the manufacturing companies, inasmuch as no manufacturing company could supply apparatus which would not infringe patents adversely held, and therefore the users of such apparatus were liable as infringers.

It was Mr. Coffin's personality and his proved capacity as a great leader in the industry that brought about, in 1892, the formation of the General Electric Company by the consolidation of the Thomson-Houston company with the Edison General Electric Company. By this amalgamation of interests the difficulties of the patent situation were largely reduced. Ultimately patent arrangements with other manufacturing companies gave to the industry, for the first time, reasonable stability and the opportunity for development on sound lines.

Mr. Coffin's attractive personality had much to do with his pre-eminent success as an organizer and executive. He made and kept friends. While he necessarily desired to dominate in business, he was always ready to serve not only those with whom he was associated but in the many good causes which appealed to him. He freely gave his time and effort to help others; unostentatious liberality was one of his marked characteristic qualities.

His public service during the World War was notable and admirable in spirit and effectiveness.

Mr. Coffin had many interests outside his work. Even when his business obligations were most strenuous he would find time to gratify his taste for good pictures by frequent visits to art galleries. He had social relations of a delightful character with men in all parts of the world.

His friends and associates will always look back with the utmost satisfaction to their relations with him and the public should regard him as a great benefactor, not only for his good works but because he contributed so much to the development of what is one of the most important features of modern life, the application to the service of man of the stupendous forces of electricity.

FREDERICK P. FISH.

Boston, Mass.

His Vacant Place a Sad Reminder

THE great figures in the electrical development of this country are one by one passing off the stage, and the death of Mr. Coffin removes one of the greatest. Thousands of men in the industry of this generation will regret the loss of a great leader, but to the few of his contemporaries there will remain while they live a vacant place as a sad reminder.

GUY E. TRIPP.

New York City.

Has Left His Mark

THE death of Charles A. Coffin brings to an end a career of achievements of which any man may well be proud. His ability to make and hold friends was one of his outstanding characteristics and his judgment in gathering around him a group of associates resulted in building up an organization which has done much to stabilize the entire electrical manufacturing industry and to put it on the high plane it now occupies. He has certainly left his mark on our industry.

Boston, Mass. CHARLES L. EDGAR.

Noted for Fairness and Justice

I FIRST met Charles A. Coffin in 1892 at the time of the organization of the General Electric Company.

I had been here for a couple of years in charge of the interests of the Thomson-Houston Company, and at the time of our meeting he arranged for my appointment as Pacific Coast manager, the position which I held up to my retirement in 1923. He was not only my superior in the organization of the great company which we both served, but he soon became my warm personal friend and my adviser, and remained so until his death. He meant far more to me than any other man I ever knew.

As years passed I had abundant and increasing reason to respect and have confidence in his business sagacity, his wisdom and good judgment, and also his justice and fairness toward those whom he believed served the company to the best ability.

In all the years I served under him I cannot recall one word of criticism or fault-finding that I ever received from him, either by letter or word of mouth, and I gladly pay him this tribute as a testimony to his fairness and justice and kindness of heart instead of to my ability to avoid errors.

As I have reason to believe from personal conversation with him when I last met him, a little more than a year ago, he had made all preparations and was then ready for the final end. Still, I know that all who have been associated with him will join me in saying that he will be greatly missed. Personally, I cherish his memory as one of the most valuable things that I have ever experienced.

THOMAS ADDISON.

Berkeley, Cal.

He Invented Methods of Business

THE death of Mr. Coffin will be severely felt by a host of friends and admirers of the truly great man he was. His high and exceptional qualities as a business head, amounting indeed to genius itself, were coupled in him with a rare and fine personality, an idealism which brought together in him many of the finest attributes of humanity, a desire to be of help wherever good results could be brought about. It was his nature to be modest and without seeking honors or preferment as a reward of his great merits. Nevertheless, he was frequently honored and in many ways, but never was any act of his directed to any such end. He was sought but never seeking.

My first acquaintance with him was in 1882 at the time when the majority interest of the American Electric Company, organized in New Britain, Conn., to exploit the Thomson-Houston arc lighting system, was taken over by what was called the Lynn Syndicate. I had worked out the system in Philadelphia, Pa., in 1878-1879, after which the work was carried on mainly in New Britain, Conn., but tended rather to languish than occupy its proper place in the developing art of lighting. There was no incandescent lighting at the time. Neither Edison here nor Swan abroad had worked out the carbon filament lamp. This did not come till late in 1879, to be replaced by the tungsten lamp, with its drawn wire filament and great economy of energy, 30 years later. After the Lynn Syndicate, the chief moving spirit in which was Mr. Coffin, took hold, the name of the company was changed to "The Thomson-Houston Electric Company" and vigorous business was carried on at the plant of the company at New Britain until, upon the completion of what is now known as Factory A, at the West Lynn Works, the manufacture was bodily removed to Lynn, with E. W. Rice, Jr., myself and a number of others as heads of the technical work.

I have the most pleasant memories of Mr. Coffin from this time, frequently meeting him and discussing with him the future possibilities of electrical industry in various directions. He seemed even then to possess a remarkable insight, a capacity of visualizing, without any background of knowledge of electricity, what the future might be. Of course, I was enthusiastic and felt a justification for it which was based on familiarity with my subject.

It was the custom of Mr. Coffin to make frequent visits to the works and inquire how things were getting on with us, and I need hardly say that his zeal and interest helped us over many a hard place. We would speak of a new invention or a possibility of new work being undertaken. His remark would be, "How soon can you have that done?" or "How long will it take to do that?" and he never forgot afterward to follow it up and commend us for any unusual advance. It was the same with our lamp work as with our a.c. transformer development, and when we entered the electric railway field the same spirit held. We started railway work about 1887, and in 1889 the whole of the street railways of the city of Boston were equipped by us for electric traction,

Boston being the first of the large cities in which all the street railway lines were electrified.

Mr. Coffin, through all this, was at the head of the company's policies. He invented methods of business, displaying originality and imagination usually attributed to artists, inventors and great engineers. He was a master of finance, and succeeded well in what nearly every other man must have failed. He was a lover of art in its various forms and had a surprising knowledge of the natural objects, such as trees and flowers. All ideas were treated in a liberal spirit. He was never narrow or bigoted in the least degree.

When it came about that the two great factors in the electric work of the time, 1891-1892, namely, the Edison General and its subsidiaries and the Thomson-Houston Electric, which had acquired affiliated industries, should be united, it was very natural that Mr. Coffin should be president of the General Electric Company, and that many of those who had worked with him should occupy offices of direction under him.

It is now nearly 35 years since that consolidation, really a great public benefit, occurred, and for the most of that time Mr. Coffin was the directing head, continuing to the last to help shape its policies. He was always deeply interested in the new or research work of the laboratory and ever confident that the future of the industry must, in large measure, depend on new discoveries and inventions.

There could be no better monument to Mr. Coffin than the great manufacturing industries which his genius helped to exist, here and abroad, with their many thousands of officers and workmen and their dependents, united in electrifying the world.

Lynn, Mass. ELIHU THOMSON.

Dean of Electrical Industry

THE death of Charles A. Coffin brings to a close the active and eventful life of the dean of the electrical industry. In the organization and direction of the General Electric Company he exhibited a clear vision of the possibilities of electrical development. At all times, even in periods of greatest depression, there was ever present a genial personality which went far successfully to solve many a complicated problem.

His many friends and associates will miss for a long time to come his hearty handshake and cheerful greeting.

New York City. W. S. BARSTOW.

A Wise Counselor and Beloved Friend

NO WORDS can express adequately the grief and sense of personal loss which I feel at the death of Charles A. Coffin. For more than 40 years he was my courageous leader, my wise counselor and beloved friend.

While Mr. Coffin did not possess a scientific or technical education, in all my experience I never have met one who showed such a lively interest in and such an intelligent grasp of the significance and value of new scientific ideas or engineering developments. Mr. Coffin used the same methods, exercised the same imagination, the same inventive power and the same rare vision in the field of finance that Edison has shown in the field of applied science and engineering.

He was one of those great leaders who arise at critical periods in the world's history and to whom men naturally turn for inspiration and guidance. His influence was not limited to the electrical manufacturing industry, which he founded, but included all applications of the electrical science and art. He was the personification of industry, a constant stimulus to greater endeavor to all who were fortunate enough to come within his influence and an ever living example of unselfish service.

E. W. RICE, JR.

Schenectady, N. Y.

Noted for Industry and Achievements

IN THE passing of Charles Albert Coffin the world has lost a great constructive genius and a real benefactor. The electric light and power industry has lost a personality whose unusual vision, resourcefulness and perseverance contributed more than that of any other to the commercial expansion and stabilization of that industry. His associates and co-workers have lost a helpful, patient and sagacious counselor, who early perceived and enthusiastically visualized the vast possibilities for the use of electricity in lightening the world's work and possessed the rare gift of easily imparting his own enthusiasm to all with whom he came in contact. He quickly won and always retained the respect, confidence and good will of his associates and coworkers, and secured—most frequently by suggestion and never by arbitrary command—the exercise of all their ability, interest and activity in giving effect to the policies and plans that he initiated or advocated. He was quick to note and commend unusual effort or achievement, but he was always charitable in judging the shortcomings or commenting on the failures of his subordinates.

Mr. Coffin never exhibited self-consciousness of the great work he performed. He was easily approachable, and his modesty and avoidance of publicity were as notable as his intense industry and brilliant achievements. He addressed himself quietly, continuously, but always effectively, to the constructive and administrative problems of the great organizations that he successively initiated and guided to most unusual and substantial success.

His loss will be most keenly felt by those men who under his direction shared with him the varying responsibilities, the labor and the vicissitudes attendant upon the general introduction of electric light and power to industry, to commerce, to finance and to the public at large during the latter part of the last century, and to those men particularly Mr. Coffin's name will always be an inspiration to achievement and recall affectionate memories of a great and kindly leader.

The General Electric Company and in a larger sense the electric light and power industry are conspicuous and lasting monuments to this man, whose vision and indomitable perseverance, ability as an organizer and leader of men and whose great accomplishments have given his name a high place with those great names emblazoned in the history of the world's industrial and humanitarian development.

Lynn, Mass. FRED M. KIMBALL.

A Master and Leader

I HAD the privilege of intimate and friendly association with Charles A. Coffin for 39 years. My entire business life is intertwined with that of my acknowledged master and leader in all activities. My fondness for him and his family is profound. His great ability, known throughout the world, was exceeded only by the charm of his personality, his kindness and thoughtfulness of others. His overpowering influence for the benefit of mankind will last forever. No man has served industry more faithfully or with such great success as Mr. Coffin in the electrical industry. May his life's work be chronicled as an inspiration to young men and as an example of high business ethics, progressive effort and accomplishments. J. R. LOVEJOY.

Schenectady, N. Y.

A Pioneer and Leader

IN THE death of Mr. Coffin the electrical world has lost one of its great pioneers and leaders, and the industrial age one of its most brilliant lights. Only those who were brought into intimate contact with his many-sided character can realize how great he was, not only as a "captain of industry" but as a man of unusual personality, buoyant enthusiasm and exceptional parts, keenly interested in a multitude of life's activities outside of that business in which he became so distinguished.

His great work, of course, was the building up, from many component parts, of a far-flung electrical organization in which he was not only the guiding spirit but its chief inspiration. In that constructive work he was not guided solely by commercial considerations, and in its upbuilding he was not free from periods of great anxiety and unusual responsibility.

He was alert to the vital bearing of high scientific research as the basis of commercial development. As an illustration of this fact it is unnecessary more than to refer to the splendid facilities placed at the disposal of men like Drs. Whitney, Thomson, Langmuir, Steinmetz and Emmet, and the liberal provision in the matter of expenditures for carrying out their investigations, as well as in the application of the results to the practical problems which arose.

His company indicated its appreciation of his spirit and labors by the establishment of the Coffin Foundation in 1922, at the time of the termination of his active leadership, thus providing tangible encouragement for creditable service and accomplishment in certain electrical fields.

Mr. Coffin, to an unusual degree for a man so actively identified with industry, had a personal side which was not generally known. He was keenly interested in and appreciative of the beauties of art, literature and nature. A splendid judge of paintings and etchings, he spent several months in getting together an interesting collection of the latter which he donated to Bowdoin College, although not a graduate of it. Again, his interest in botany and his knowledge of trees and plants were most unusual, as typified in the splendid development of his country home.

In all his work he found distraction and a measure of peace following the great blow which came to him on the sudden death of his only son, in whom his affections and ambitions were so greatly centered.

His charities were many, and his individual benefactions, largely unknown to the public, brought happiness and relief to many people who individually will mourn the loss of a friend of generous impulses. They, and all the other friends, of whom Mr. Coffin had a myriad, will feel his passing as a great personal loss.

FRANK J. SPRAGUE.

New York City.

He Gave Unselfishly of His Time and Talent

CHARLES A. COFFIN has gone to join "the innumerable caravan which moves to that mysterious realm" whence no man returns. His going from us is a cause of deep regret, but the memory of his life fills our hearts with gladness. By unselfishly giving of his time and talents he performed a noble service for humanity not only through varied associations in the electrical industry at large but also through many charitable and civic interests. As a consequence his spirit will live on and on forever, for the good that men do cannot be forgotten. The General Electric Company in the passing of its first president and the honorary chairman of its board loses a true friend, his loyalty and devotion to the highest ideals of the organization being manifest upon every occasion.

J. A. CRANSTON.

San Francisco, Cal.

Water Power to Build Up Steel Industry in Chile

The Republic of Chile, which is rich in iron-ore deposits, expects soon to establish a steel industry through the Compañia Electro Siderurgica e Industrial de Valdivia, a private enterprise backed by the government. The industry is to be based on the development of cheap water power in southern Chile within easy transmission distance of Corral, where there is a smelting plant. It is now proposed to use this power for the reduction of the iron ore by processes which have been successfully developed in Sweden and other European countries.

It is planned to build a hydro-electric plant of 35,000 hp. rating in the Valdivia Lake region, with a transmission system and substations to deliver power to Valdivia and to a proposed new steel plant at Corral. This plant is to have an initial yearly output of 50,000 tons. An engineering report recently made by the Engineers' Corporation, a subsidiary of the J. G. White Engineering Corporation of New York, shows the project to be well founded. The Engineers' Corporation will carry out the engineering and construction of the proposed development, under contract with the managing director of the steel company, Victor M. Navarrete.

East Central N.E.L.A. Breaks All Records

Need for Sales Department Organization Emphasized—Inductive Interference and Alternating-Current Networks Discussed —Meeting Voted Unusual Success

BREAKING all previous records of attendance for divisional conventions with a total registration of 1,058 members and guests, the annual meeting of the East Central Division of the National Electric Light Association, at Cedar Point, Ohio, July 13 to 16, was a notable success both as a business and social gathering.

On Thursday the morning session was given over to the discussion of technical problems. Prof. A. M. Wilson, University of Cincinnati, outlined the progress and results of the inductive co-ordination committee's work.

That Europe is now copying American engineering practices was brought out by Dean Paul Anderson of the Engineering School, University of Kentucky, who made a plea for thoroughgoing Americanism in the arts and sciences.

In discussing the progress and development of prime movers and operating practice A. Carnegie, the chairman of this committee, emphasized the benefits that central-station operators derive from the inspection of new power plants and round-table discussions to enable the interchange of ideas between engineers. He stressed the value of preparation of papers for presentation in the technical press and urged that members in this manner enlighten the rest of the industry as to their most recent developments.

Commercial and new-business topics occupied the center of the stage on Thursday afternoon. M. P. Walsh, chairman Commercial Section, urged upon the members the need for development of a definite sales program and pointed out that surveys of the possible available loads showed that the business has thus far been only about 10 per cent developed Discussion of the different fields for obtaining new load followed. Walter Sammis, chairman of the national sub-committee on industrial heating, estimated the available industrial heating loads as somewhere between 2½ and four times the present motor load.

In reviewing the rapid development of electric refrigeration, George Durban, the Delco Light Company, declared that it was impossible at this time to estimate the possible growth of this load.

The principal problem with which electric utilities are confronted in increasing the use of household appliances, declared K. Fitzpatrick, Jr., is the lack of adequate wiring in the home.

Discussing the difficulties to be surmounted by the central-station industry in endeavoring to increase its sales activities, C. L. Dunn said: "I believe the lack of co-ordination of ideas of the various companies on organization and compensation is reflected in the minds of our executives to the detriment of the sales department, and the sooner we recommend a sound commission basis and efficient organization plan the quicker this department will be elevated to the place it belongs, which, at least, is equal to any other department of a company. This cannot be accomplished if we continue to pick men from all walks of life, without any knowledge of our business, and send them out without training.

Results of the industrial lighting campaign, declared H. W. Derry, show the need for and possibilities of systematic organization for sales. In discussing the future of sales organization, S. D. Heed called attention to the fact that any sales plan must recognize the fact that it is facing keen competition for the customer's dollar from many other industries. It will be necessary to carry sales activities directly to the customer's door and it will mean that only a very high type of sales personnel can be expected to be successful in this work.

Friday morning's session was given over to a round-table discussion of technical problems, a feature of which was a highly interesting description of the adoption of alternating-current, secondary networks automatically controlled, presented by H. C. Richter. Fourteen of the larger cities in the country have adopted this system of distribution and indications are that it will be more generally adopted as load density increases. Some of the probable future developments resulting from the adoption of the automatically controlled networks, Mr. Richter said, will be larger three-phase transformers, tying generators together through feeders instead of through the station bus, elimination of substations by use of higher voltage, extension of this system to cover entire cities, including both overhead and underground systems; possibility of network distribution being adopted by industrial plants as already in use at the Bush Terminal, Brooklyn.

At the close of the session on Friday the following officials and executive committee were elected: J. P. Pope, president, Lexington, Ky.; C. I. Weaver, vice-president, Springfield, Ohio; G. E. Miller, vice-president, Cleveland, Ohio; C. S. MacCalla, vice-president, Youngstown, Ohio; D. L. Gaskill, secretary-treasurer, Greenville, Ohio. Executive committee: L. B. Herrington, Louisville, Ky.; T. B. Wilson, Louisville, Ky.; A. Bliss McCrum, Charleston, W. Va.; C. P. Billings, Pittsburgh, Pa.; T. O. Kennedy, Cleveland, Ohio; O. H. Hutchings, Dayton, Ohio.

Hearing on White River Applications Set for Aug. 2

Additional data submitted by the Ozarks Hydro-Electric Power Company do not convince the staff of the Federal Power Commission that its plan for the development of the White River in Arkansas is as comprehensive as that of the rival applicant, the White River Power Company. The Ozarks company has appealed to the commission. The commission will listen to the arguments of its own staff and to those of the parties in interest on Aug. 2.

The Arkansas Railroad Commission recently announced that it had canceled the state rights of the White River company. The company, however, contends that there is no good cause for the revocation of its rights and has carried the matter to the courts. The White River company contends that it holds by virtue of action by a majority of the stockholders the right originally possessed by the old Dixie Power Company. The Ozarks company lays claim to the same rights by virtue of action taken by officials of the Dixie Power Company. The controversy has been carried to the courts in Arkansas. The White River company is a North American subsidiary. It plans to transmit the power to St. Louis. The Ozarks company is an H. C. Couch concern. Its plan is to feed the power into the interconnected system being developed in the South.

Consolidation of Ohio Utilities

By the consolidation of the Southern Ohio Electric Company with the Ohio Utilities Company a new name, "United Ohio Utilities," is added to the roster of central station companies. The new company will serve the cities of Chillicothe, Delaware, Circleville, Gallipolis, Athens, Nelsonville, Pomeroy, Middleport, Jackson and a number of adjacent towns. It will be controlled and operated by the United Light & Railways Company.

A projected system of 450 miles of high-voltage transmission lines will tie the properties together.

B. J. Denman, vice-president and general manager of the United Light & Power Company, will be the president of the new company and J. B. Hill, formerly of the Lincoln (Neb.) Gas & Electric Company, will be manager.

Municipal Plant of Kansas City, Kan., Investigated

Inauguration of a movement to increase rates in the municipal water and light department of Kansas City, Kan., has led to an investigation which is attracting widespread interest among both protagonists of political ownership and advocates of private ownership. The lighting plant, one of the largest municipal enterprises of its kind in the country, has long been alluded to as an example of success in city ownership of public utility service. None the less, C. D. Darnall, water and light commissioner, acting with the advice and co-operation of a citizens' committee, recently undertook an upward revision of the rates, after being led to believe that the annual reports showing profits were fictitious.

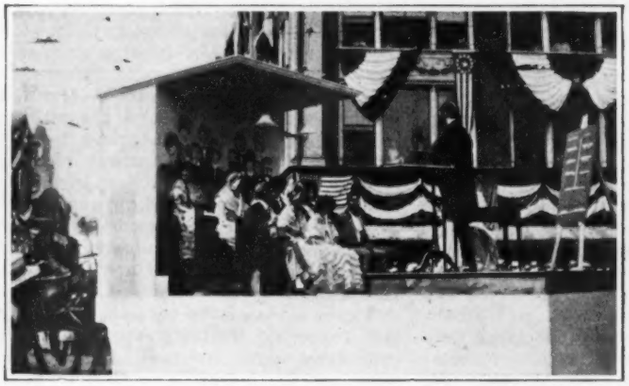
To determine the facts, Mr. Darnall obtained the services of Dean P. F. Walker, head of the engineering school of Kansas University, and Prof. George C. Shaad, head of the electrical department of the university, to make a survey. Their findings are now undergoing the scrutiny of the state's Attorney-General. Paper profits of $1,848,705 accumulated over the life of the plants will be wiped out entirely and replaced by a substantial deficit, according to published statements made by auditors working on the department's books. A shortage of $858,919 exists in the bond sinking-fund alone, according to figures disclosed in the audit report of Dean Walker and Professor Shaad. Characterizing as "ruinous" certain practices resorted to in the department in the past, Dean Walker declares that increased rates are mandatory.

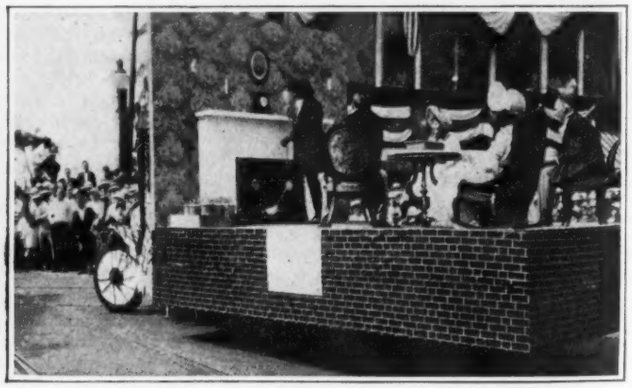
City Project on Wynooche No Obstacle to Cowlitz Plans

Following the passage by more than 1,600 votes at a recent special election of the proposed two-million-dollar bond issue to be used by the city of Aberdeen, Wash., in the development of the Wynooche River power project as a municipal hydro-electric enterprise, the City Council announces that preliminary work will proceed immediately. The first step will be the purchase of 700 acres of land and the canyon dam site, on which a 4-mile railroad will be built at once. The initial development of the Wynooche calls for the construction of a 115-ft. dam about ¼ mile from the mouth of the Wynooche Canyon. This dam will create a lake about 2 miles long and slightly less than a half mile wide. Ultimate development calls for a dam 240 ft. high, which will create a lake 7 miles long and almost a mile wide at its greatest width. The large lake would flood 2,600 acres.

Authorization of the Wynooche municipal project by the voters will not stop the plans of the Gray's Harbor Railway & Light Company (outlined in the issue for June 12, page 1315) to develop a twenty-million-dollar hydro-electric project on the Cowlitz River, according to W. W. Briggs, vice-president and general manager. The first unit, which, late information says, will develop 49,000 kw. at a cost of about $6,500,000, will be situated near Mayfield, about 25 miles southeast of Chehalis. This portion of the development will require a dam 155 ft. to 185 ft. high. Floodage rights extend up the Cowlitz River into Young's Canyon north of Mossy Rock. A second and third step

Electric Utility Companies Aid Salem's Tercentenary Celebration





ELECTRIC utility companies played a prominent part in the recent celebration of the three hundredth anniversary of the founding of Salem, Mass. The Salem Electric Lighting Company contributed an extensive increase in street lighting without charge, about 135 lamps being changed from a 250-600 cp. range to 1,000 cp., the increase being for the entire month of July. Streamer lighting from the stack of the generating station to the roof by about 1,000 colored lamps of 15 to 25 watts and two searchlamps on the station roof were also features. In the various parades the company was active, a noteworthy float showing a finely equipped electric kitchen with porch light and ventilating fan in addition to a range, refrigerator, ironer, cooker, washer and other devices. The Eastern Massachusetts Electric Company contributed a transmission-line truck complete with crew, and the Hygrade Lamp Company provided a historical float (shown on the right) representing the early demonstrations of Prof. M. G. Farmer in incandescent lighting. Bell telephone history was shown by the New England Telephone & Telegraph Company by a float (left) on which Alexander Graham Bell explained his invention to an audience 50 years ago.

in the complete development now contemplated will produce a total of 166,000 kw. The rivalry for this site, reported in the March 6 and previous issues of the ELECTRICAL WORLD, will, it is thought, now be settled amicably in favor of the Gray's Harbor company.

Briefer News

New Office Building.—The Utica Gas & Electric Company, Utica, N. Y., will erect a six-story modern office building at Court and Genessee Streets, that city. Under the plans there will be no general contractor, each contractor being directly responsible to the architect and work under his supervision. The building will be ready for occupancy, it is expected, April 1, 1927.

Kalweit Buys Nebraska Company.—The Albion (Neb.) Electric Light Company has been sold to George W. Kalweit, vice-president of the Milwaukee Electric Company, for the latter, for a cash consideration of $180,000. It will form part of a chain of utilities recently purchased, other Nebraska companies taken over being the Columbus Gas Company and the Norfolk Fuel & Gas Company. This is the Milwaukee company's only electric unit in the state. The plant has 650 customers. It has been owned since 1908 by G. K. Pittenger and associates, who had refused previous offers for a slightly higher figure which represented part stock payments.

Third Unit of Long Beach Plant.—The Southern California Edison Company has announced the completion of unit No. 9 of its Long Beach steam plant. This, the third large unit to be constructed at Long Beach in less than 2½ years, is to have a maximum capacity of 85,000 hp., which will bring the total capacity of the plant to 305,000 hp. and make it the largest steam generating plant west of the Mississippi River. The turbine was built by the General Electric Company, while the condenser was furnished by the Westinghouse Electric & Manufacturing Company. Connelly boilers were installed. The seven boilers are equipped with Bailey water-cooled furnace walls to prevent heat loss due to radiation. Stone & Webster, Inc., acted as engineers on the project and in completing the work in less than eleven months created a new record for speed and efficiency. The completed cost has been set at $5,500,000.

California Water Power Act in Resurrection. — The twice defeated water and power act again will find its place upon the initiative ballot in California fall elections. This became a fact June 30, by the filing with Frank C. Jordan, Secretary of State, of petitions containing 82,318 names of qualified electors. This measure is identical with the two preceding measures intended to authorize the state of California to issue $500,000,000 worth of bonds for the development of water for irrigation and hydro-electric power. The required number of signatures to give a measure place upon the ballot is 77,263. The petition from Alameda County, containing 11,332 names, gave the measure the number of names necessary to qualify. San Francisco names totaled 20,698. In Los Angeles, where the measure was falsely represented as being in support of Boulder Dam, 50,288 signatures were obtained. First submitted in 1922, the water and power act was turned down decisively by a majority of more than 353,000 votes. Again submitted in 1924, it was turned down by a majority of 432,000 votes. The measure to be submitted in November is identical in wording and form with those defeated in the two previous attempts.

Petition to Establish Regulating District on Salmon River, N. Y.—Light and power companies and industrial firms have joined the village of Malone and other municipalities in applying to the State of New York for the establishment of a regulating district on the Salmon River. It is desired to impound 4,000,000,000 cu.ft. of water in a natural basin near Titusville, Franklin County. By this plan, the petitioners say, seasonal non-employment due to lack of water power in the dry season would be cut in half, energy available for industrial plants would be increased from 2,000 hp. to 15,000 hp., coal would be saved and floods averted. The cost is estimated at $1,000,000, to be assessed against the industries and properties benefited. The Association for the Protection of the Adirondacks and the Saranac Lake Chamber of Commerce oppose the application, chiefly because 1,000 acres of state land would be inundated. A hearing before the New York State Water Control Commission was adjourned until Sept. 1.

Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations, with their secretaries, is published in the first issue of each volume. For latest list see ELECTRICAL WORLD, July 3, page 50.]

Association of Electragists International—Hotel Breakers, Cedar Point, Ohio, Aug. 24-27. L. W. Davis, 15 West 37th St., New York.

Camp Co-operation VI (local leagues)—Association Island, Henderson Harbor, N. Y., Sept. 1-4. (Society for Electrical Development, New York, is sponsor.)

Wisconsin Utilities Association, Electric Section—Eau Claire, Wis., Sept. 3 and 4. J. N. Cadby, 445 Washington Bldg., Madison, Wis.

Illuminating Engineering Society — Essex and Sussex Hotel, Spring Lake, N. J., Sept. 7-10. L. H. Graves, 31 West 46th St., New York.

Rocky Mountain Division, N. E. L. A.—Glenwood Springs, Col., Sept. 13-16. O. A. Weller, Public Service Co., Denver.

New England Division, N. E. L. A.—Poland Spring House, Poland, Me., Sept. 20-23. Miss O. A. Bursiel, 149 Tremont St., Boston.

International Association of Municipal Electricians — Battery Park Hotel, Asheville, N. C., Sept. 21-24. E. H. Benz, West New York, N. J.

Great Lakes Division, N. E. L. A.—French Lick. Ind., Sept. 23-25. R. V. Prather, 205 Illinois Mine Workers' Bldg., Springfield, Ill.

Association of Edison Illuminating Companies — Chateau Frontenac, Quebec, Sept. 27-Oct. 1. P. S. Millar, 80th St. and East End Ave., New York.

Public Utilities Association of West Virginia—Charleston, W. Va., Oct. 1 and 2. A. Bliss McCrum, secretary.

Empire State Gas and Electric Association—Lake Placid Club, N. Y., Oct. 4 and 5. C. H. B. Chapin, Grand Central Terminal, New York.

American Electric Railway Association—Cleveland, Oct. 4-8. J. W. Welsh, 292 Madison Ave., New York.

American Electrochemical Society—Hotel Washington, Washington, Oct. 7-9. C. G. Fink, Columbia University, New York.

Kansas Section, N. E. L. A.—Manhattan, Kan., Oct. 14-16. H. Lee Jones, 401 National Reserve Bldg., Topeka, Kan.

Consider Municipal Plant Sale.—On July 26 Earl R. Ernsberger, president of the Southwestern Light & Power Company, will offer a proposition to the City Council at Altus, Okla., to buy the municipal light and power and waterworks properties and to complete the Lugert water project. The Council has set July 27 for letting the contract for the Lugert construction project and the sale of bonds voted for this purpose on July 26. If the Ernsberger proposition is accepted the bonds will not be sold.

Harpers Ferry Water-Power Project Dropped.—Word comes from Cleveland that the project of harnessing the Potomac and Shenandoah Rivers in the vicinity of Harpers Ferry, W. Va. (referred to in the ELECTICAL WORLD for March 13, page 573), has been dropped by the Potomac River Corporation, organized in the Ohio city, and that preliminary equipment installed at Martinsburg, W. Va., is being dismantled. Robert J. Bulkley, the president of the company, is quoted as saying that the principal reason for withdrawing was that the Harpers Ferry Paper Company refused to recognize options his company had obtained on its properties and water rights. Reports had found their way into print to the effect that the rivers named were capable of furnishing large quantities of power to residents of Maryland, Virginia and West Virginia, as well as to Washington and even Baltimore. It seems probable that the survey made showed, as had prior investigations by the federal government, that the power possibilities had been overrated.

A Franchise and the Fixing of Rates.—The taxpayers of Denver, Col., will be asked to vote on the granting of a twenty-year franchise to the Public Service Company of Colorado at a special election to be held Sept. 21. As the matter stands the voters are to be asked to vote the renewal of "the franchise," the rates to be fixed by the City Council. The chairman of the councilmanic committee said: "We will cover the rate question separately from the franchise by municipal ordinances, although the two will be interlocking and one will not be adopted without the other. In this manner the franchise will cover only the questions of operation, service, extensions and similar questions. The rate-making ordinances will establish the rates. This method of control is that provided by the state constitution. By handling the situation in this way, the right to change the rates at any time revision may be necessary will be reserved to the people. Then, in later years if a change is found necessary, action may be taken either by vote of the people on an initiated ordinance or by the City Council.

Men of the Industry

C. G. Stoll Elected Vice-President of Western Electric

Clarence G. Stoll, general manager of manufacture of the Western Electric Company, has been elected a vice-president to succeed the late H. F. Albright. Mr. Stoll was formerly manager of the Western Electric Hawthorne Works in Chicago. His association with the company began 23 years ago, when he entered its ranks as a student engineer in Chicago. After serving in various capacities in the New York and Chicago offices, he was promoted to be head of the manufacturing branch in New York in the summer of 1912. In the fall of that year he was appointed shop superintendent of the factory at Antwerp, Belgium, but following the outbreak of the war he returned to America and took over the European automatic department at Hawthorne. Later he became superintendent of the operating branch and subsequently superintendent of the technical branch. He was named assistant general superintendent at Hawthorne in 1920 and in February, 1923, he was put in charge of all departments at Hawthorne and given the title of works manager.

A. G. Curtis, vice-president of the Southwestern Gas & Electric Company, Shreveport, La., has resigned. Mr. Curtis has been succeeded by **M. T. Walker,** who formerly held the same position at Beaumont, Tex.

Walter S. Van Sickle has been appointed assistant general manager of the Fort Smith (Ark.) Light & Traction Company in charge of operations in 22 municipalities as supervisor of the plants of the Mississippi Valley Power Company. The Mississippi Valley utility is controlled by the Fort Smith Light & Traction Company.

L. J. Belnap, formerly president of the Rolls Royce Company of America and chairman of Wills-St:Claire, Inc., of Detroit, has been elected president of the Worthington Pump & Machinery Corporation. **Charles Philip Coleman,** retiring president, has been chosen chairman of the board of directors. Mr. Coleman has been affiliated with the Worthington Pump organization since 1916 and has been chief executive since 1918. A graduate of Lehigh University, Mr. Coleman was formerly vice-president of the International Steam Pump Company, an associate company of the Worthington Pump & Machinery Company, and upon the outbreak of the war was made one of the co-receivers of the company, becoming sole receiver in 1915.

G. G. Ponti, deputy of the Italian Parliament and general manager of the Società Idroelettrica Piemonte and affiliated hydro-electric companies, has been in this country for the past two months studying high-tension systems and hydro-electric developments. Upon his return from the Pacific Coast Professor Ponti addressed a special midsummer meeting of the Metropolitan New York section of the National Electric Light Association held on July 19. The subject of the illustrated lecture was "Development of the Hydro-Electric Resources of Italy and the Industrial Utilization of Electrical Energy." Professor Ponti sailed for Europe July 21 aboard the Cunard liner *Mauretania.*

A. W. Robertson New President of Philadelphia Company

Andrew W. Robertson, who was elected president of the Philadelphia Company and affiliated corporations, as announced in the July 17 issue of the ELECTRICAL WORLD, is well qualified, both by training and experience, to head the utility companies serving Pittsburgh and vicinity. A resident of Pittsburgh for twenty years, he has been in close touch with the development of the greater Pittsburgh district, and his experience as an executive of the Philadelphia Company dates back to 1913. As vice-president in charge of public relations he has been in touch with operations generally and in direct charge of the general service department, which maintains all relations with domestic customers of the company, the adjustment or claims department, the advertising department and relations with the Public Service Commission.

A. W. ROBERTSON

Mr. Robertson was born in Panama, N. Y., in 1880 and attended Allegheny College at Meadville, Pennsylvania, graduating in 1906. He then entered the law school of the University of Pittsburgh, from which he was graduated with the degree of LL.B. in 1910, and was admitted to the bar. After several years of general law practice he became attorney for the Pittsburgh Railways and the Duquesne Light Company in 1913. In 1918 he was made general attorney for the Philadelphia Company and affiliated corporations, and in 1923 was elected vice-president in charge of public relations, retaining also his position as general attorney.

Mr. Robertson will assume the duties of his new office Sept. 1.

W. H. Cahoon, formerly connected with Ford, Bacon & Davis, Inc., engineers, has joined the staff of George F. Hardy, consulting engineer, with offices in New York, in the capacity of electrical engineer.

Obituary

Charles A. Luckenback, third vice-president and treasurer of the Los Angeles Gas & Electric Corporation, died July 9, at the age of 61, after a month's illness. Mr. Luckenback was born in Bethlehem, Pa., March 24, 1865. He was graduated from Lehigh University in 1886, immediately thereafter entering the employ of the Crane Iron Company of Catasauqua, Pa. In 1889 he removed to the city of Los Angeles and from 1890 to 1897 he was employed by the city of Los Angeles, first as deputy city clerk and later as city clerk. In 1898 he began his career in the public utility field with the Los Angeles Gas & Electric Corporation as purchasing agent. In 1905 he was made manager of construction. It was in 1917 that he was elected third vice-president and a member of the board of directors. The additional duty of treasurer was assigned to him in 1924.

Oberlin Smith, pioneer manufacturer and president and principal owner of the Ferracute Machine Company for 63 years, died at his home in Bridgeton, N. J., July 18 in his 86th year. Mr. Smith was born in Cincinnati in 1840 and was educated at the West Jersey Academy, Bridgeton, N. J., and at the Polytechnic Institute, Philadelphia. In 1863 he started the business which is now the Ferracute Machine Works and from that time invented and designed its standard products. Mr. Smith was a past-president of the American Society of Mechanical Engineers and a member of the American Institute of Electrical Engineers, the American Society of Civil Engineers, the American Institute of Mining Engineers, the Franklin Institute of Philadelphia, the American Iron and Steel Institute and the Engineers' Club of New York and a fellow of the American Association for the Advancement of Science.

W. D. Cole, for the past six years general auditor of the Kansas Power & Light Company, Topeka, died in that city July 5 after an illness of two months. Upon his graduation from high school Mr. Cole became associated with the Illinois Traction system and continued in the service of that company or its associated interests until his death. Prior to his association at Topeka he served as auditor for the Illinois Power & Light Corporation at Urbana and Jacksonville, Ill. Mr. Cole was a prominent figure in the activities of public service associations in the Middle West, having served as chairman of the accounting section, Middle West Division, N.E.L.A., chairman of the accounting division of the Kansas Public Service Association, and shortly before his death was made a member of the accounting division of the Kansas Section, N.E.L.A.

Recent Court Decisions

Water "Flowing Over Crest" of Dam Means Water Flowing Over Flashboards.—United Paperboard Company vs. Iroquois Pulp & Paper Company was a suit to determine the meaning of rights retained in a conveyance of riparian land to use of water "actually flowing over the crest" of a dam. The New York Supreme Court, Appellate Division, held that this clause permitted the use of water by grantor only when it was actually flowing over the dam including flashboards erected by permission of the state, if said flashboards were in place, and did not permit the use of water when its level was merely higher than the crest of the original dam exclusive of flashboards. Otherwise another clause of the deed, allowing water to be taken when not required for the needs of the grantee, would, the court said, cease to have any practical effect and would become meaningless. (215 N.Y.S. 741.)*

Public Convenience and Necessity Defined.—A clear declaration on "public convenience and necessity" is found in the decision of the Supreme Court of Illinois in Illinois Power & Light Corporation vs. Illinois Commerce Commission, denying a rehearing. The court said: "The policy established by legislation for the regulation of public utilities is to provide the public with efficient service at a reasonable rate by compelling an established public utility occupying a given field to provide adequate service . . . and at the same time to protect it from ruinous competition . . . By the adoption of this act it became the public policy of the state that free competition among public utilities did not promote the public service. Whether this policy is sound rests with the legislative department of the government and not with the judiciary . . . If the company now occupying the territory is incapable of providing adequate service, then, and not until then, will a situation arise when the public convenience and necessity may require the establishment of another utility." (151 N.E. 236.)

Ownership of Residential Wires Conducting Lightning Not Material in Determining Care Required.—In Farr vs. Alabama Power Company, a suit for damages because of a death from lightning alleged to have been introduced into the house of decedent over electric wires, the defendant raised the point that it had not been shown that the lightning entered the premises over the company's wires and maintained that it might have struck the interior wires belonging to the customer. The Alabama Supreme Court held this point not to be material, the utmost care being required to safeguard equipment over which service was given, regardless of the ownership. Moreover, evidence that neighbors of the victim were also shocked was held competent as indicating that the bolt struck the company's secondary line and that it must therefore have been insufficiently grounded, rendering the defendant susceptible to the charge of negligence on this count also. (108 So. 373.)

Right of Commission to Punish for Contempt.—The Louisiana Public Service Commission having attempted under a constitutional provision to punish for contempt a spectator at hearings held before it, this individual (Williams) sued for a writ of prohibition. He has been sustained by the Supreme Court of the state, which, disclaiming power to review the case, found nevertheless that the commission had not observed the proper legal formalities and therefore granted the writ of prohibition. (108 So. 487.)

Does a Last-Minute Payment Give Right to Punitive Damages for Discontinuance of Service?—The Supreme Court of Appeal of Virginia has granted a writ of error to the Virginia Railway & Power Company in its appeal from an award by the Circuit Court at Norfolk to J. E. House for $400 punitive damages because plaintiff's electric service was disconnected for non-payment of his bill and remained off 24 hours, although he paid the bill during the day that the light was cut off. It was contended by the company that the contract called for payment of bills within fifteen days of presentation, otherwise light might be cut off with or without notice. The operating department of the company observed this rule, not knowing that the accounting department had received payment.

Municipal Order to Confiscate Utility Property May Be Tried in Equity.—Asserting that "The court judicially knows that the defendant city may not engage in the business of telephone service, that there is no concern capable of rendering efficient or any telephone service in the city and that to qualify for such service would require an expenditure of large sums of money and much time in the placing of equipment, that the property in issue is an integral part of the telephone system of the plaintiff throughout the state and to be deprived of its use would prevent efficient service and destroy the revenues, not only local, but long distance as well, the United States District Court for the Western District of Washington, in Pacific Telephone & Telegraph Company vs. Seattle, refused a motion to transfer the case from the equity side of the court to the law side. The court asserted further as reason for its decision that an ordinance of the city of Seattle directing the Superintendent of Public Utilities to seize certain of the plaintiff's telephone property under circumstances that would work irreparable injury if the superintendent carried out such direction, as he threatened, was the delegation of power which the city could not authorize under the law.

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

Coal Clause Approved.—Upon a consolidated company acquiring with certain departments of a utility the power plant of the street-railway department, which was excluded from the consolidation, it was held by the Nebraska Public Service Commission that a contract to sell power to the street railway at a basic price which is less than the present cost of production but which price may change as the cost of steam coal increases or decreases, and which not only gives the commission authority to approve when a change other than in the coal clause is submitted, but authorizes an investigation on the commission's own motion at any time, was in the public interest.

Purchase of Plant with Undetermined Value.—In passing upon the purchase of the Murfreesboro Light & Power Company by the Tennessee Electric Power Company, the Tennessee Railroad and Public Utilities Commission said that where, as in this case, one utility company had purchased the property of another without any valuation having been made for rate-making purposes, the purchase price should be carried on the books of the vendee as a specific suspense account, and if it appeared that the price was in excess of the rate-making value, the excess should be amortized out of surplus and should not be included in the fixed-capital account.

Combined Lighting and Power Rate.—No discrimination, says the Missouri Public Service Commission, is involved in a rate for combined lighting and power service greater than the rate for power alone when lighting is supplied in connection with power either through a motor-generator or direct from power mains inside buildings, notwithstanding that the motor-generator of a factory is not dependent solely on electricity and is operated by steam or gasoline. This decision was enunciated in a complaint brought by the Duffs-Trowbridge Stove Manufacturing Company against the Hannibal Board of Public Works. The commission said: "Complainant until recently passed most of the energy purchased by it through motor-generator sets, presumably to change the voltage for operation of its machinery. Complainant contends that the energy used for the operation of the motor-generator is used for power service in the same manner that energy is used to operate other machinery, and that, therefore, there should be no differentiation in the rate. . . . The passing of energy through motor-generators changes the character of the energy but does not change the character of use of that energy. After the energy passes through complainant's motor-generators it is used for power service and for lighting service. It, therefore, appears that in order to avoid unjust and unreasonable discrimination the application must be denied."

Financial and Corporate

Utility Market Improves

Gains of 2 and 3 Points Numerous in List of Net Changes for Week of Moderate Trading

WITH the resumption of the upward trend in the general list on the New York Stock Exchange the power and light issues during the week ended July 20 advanced in impressive, even if not in spectacular, fashion. The continuation of easy money has helped along the market in equity issues as well as that in bonds and preferred stocks, but in addition, of course, the lively character of the summer business is an important factor.

Lehigh Power Securities on the New York Curb Market again has attracted wide attention, and under the stimulus of greatly increased activity at one time reached a new high level for the movement at 18½, which compares with a price of 14⅝ last week. Among the Electric Bond & Share issues, however, American Power & Light was perhaps the star performer in its forward move of 6¼ points on the big board. American Gas & Electric Company's common stock advanced about the same amount during the week. Following the annual meeting of the Southeastern Power & Light Company, at which that utility increased its authorized capital, the stock rose and closed about 2½ points above the position that it held last week.

Among the issues that gained ground during the period under review were General Gas & Electric B, National Public Service participating certificates, Washington Railway & Electric, Electric Bond & Share, Electric Investors, Inc., and several of the important preferred stocks.

Merger of Indiana Utilities Completed

Fifteen million dollars was distributed by the Union Trust Company of Indianapolis June 25 to the holders of 71.43 per cent of the common stock of the Indianapolis Light & Heat Company. The money was the consideration in part for the sale of stock to the Indianapolis Power & Light Company, the holding company organized recently to take over the majority stock of the Light & Heat Company. The money was paid to the Union Trust Company by the Chase Securities Company, a subsidiary of the Chase National Bank of New York. In the deal, closed in New York, the Union Trust Company acted as escrow agent, holding all stocks and bonds till the consummation of the deal.

For their holdings in the Light & Heat Company the stockholders received $15,000,000 in money, that being the equivalent of $500 a share for the common stock of a par value of $100 and in addition one and one-half shares of 7 per cent second preferred stock carrying voting power for each share of common stock sold.

In closing the deal the representatives of the stockholders received from the holding company the second preferred voting stock and $10,000,000 of 6 per cent bonds and $4,000,000 of 7 per cent first preferred stock of the holding company. The first preferred stock and the bonds were then sold for cash to a group of banks headed by the Chase National Bank, realizing in all with certain payments already made the total of money distributed to the stockholders.

Pacific Gas & Electric to Change Set-Up

Directors of the Pacific Gas & Electric Company have called a special meeting of stockholders for Oct. 11 to vote on a proposal to split up both the common and preferred stocks on the basis of four for one. The plan includes a reduction in par value from $100 to $25 per share.

Dividends Declared

The quarterly dividends listed below have been announced by electric light and power and electrical manufacturing companies:

Name of Company	Per Cent	When Payable
Broad River Power pf.	1¾	Aug. 1
California-Oregon Power pf.	1¾	Aug. 2
Cedar Rapids Mfg. & Pwr.	¾	Aug. 16
Central & So. West Utilities com.*.	$1.00	Aug. 2
Central & South West Utilities pr. ln. pf.	$1.75	Aug. 16
Central & South West Utilities pf.	$1.75	Aug. 16
Dallas Power & Light pf.	1¾	Aug. 2
Eastern States Power pf. A	$1.75	Aug. 1
Electric Storage Battery com. & pf.	$1.25	Oct. 1
Illuminating & Power Secur., com.	.45	Aug. 10
Illuminating & Power Secur., pf.	1¾	Aug. 14
Indianapolis Power & Light, 1st pf.	1¾	Aug. 1
Knoxville Power & Light, pf.	$1.75	Aug. 2
Long Island Ltg., com.	.50	Aug. 1
Middle West Utilities, com.	$1.50	Aug. 16
Montreal Lt., Ht. & Pwr.	2	Aug. 16
Montreal Lt. Ht. & Pwr. Consol.	2	Aug. 16
National Power & Light, com.	.20	Sept. 1
North West Utilities, 7% pf.	$1.75	Aug. 16
Northern N. Y. Utilities, pf.	1¾	Aug. 1
Pacific Gas & Electric, pf.	$1.50	Aug. 15
Pacific Lighting, com.	4	Aug. 16
Pacific Lighting, pf.	1¾	Aug. 16
Pacific Power & Light	1¾	Aug. 2
Southern California Edison, com.	2	Aug. 15
Texas Power & Light, pf.	1¾	Aug. 2
Washington Water Power, com.	$2	July 15

*Semi-annual.

Company Reports

The following statements of earnings have been issued by electric light and power companies for the month of June:

Name of Company	Gross Earnings for June 1926	1925
Adirondack Power & Light.	$745 488	$629 327
Detroit Edison*.	3 352 361	2 807 769
Florida Power & Light.	1 194 434	723 569
Lexington Utilities.	179 584	161 159
Ottawa & Hull Power.	32 020	26 980

* Includes other revenue.

American Water Works Makes Record Earnings

American Water Works & Electric Company, Inc., for the year ended May 31, 1926, reported consolidated gross earnings of $43,028,970, comparing with $38,980,508 for the previous year, an increase of $4,048,462. The consolidated gross earnings for the year ended May 31, 1926, are the highest ever reported by the company in any consecutive twelve-month period. Gross income after operating expenses and taxes amounted to $20,275,019, also a new high record. This compares with gross income after similar charges for the 1925 period of $17,500,034, an increase of $2,774,985. Earnings after reserves for renewals and replacements and available for dividends were $3,699,615, also a record figure. This is equivalent to $4.29 a share on the 632,122 shares of common stock outstanding as of May 31, 1926, or $4.60 a share on the average amount of common stock outstanding during the period—in both cases after allowance for first preferred dividend requirements.

Consolidated gross earnings of the West Penn Electric Company, which controls all the electric properties of the American Water Works & Electric Company, for the year ended May 31, 1926, were $32,630,107, compared with $30,354,547 for the corresponding period of 1925, an increase of $2,275,560. Gross income after operating expenses and taxes was $14,645,526, against $12,915,366, a gain of $1,730,160.

New Capital Issues

During the week ended July 22 an interesting piece of financing was done by the West Penn Power Company in the form of an issue of first mortgage gold bonds amounting to $18,500,000. These series G 5 per cent bonds, dated March 1, 1916, and maturing June 1, 1956, were offered at 100½ and interest, this price of above par reflecting the favorable position in which the company finds itself at the present time. The first mortgage bonds are secured by a first mortgage on all the fixed property, rights and franchises now owned by the company and will be secured by a direct mortgage on all such property hereafter acquired. The proceeds of the issue will be used to provide funds for the retirement of first mortgage 7 per cent gold bonds, series D, totaling $6,000,000, partially to reimburse the company for funds expended in the purchase of the Connellsville power station, for permanent improvements, extensions or additions or new or additional property, made and to be made or acquired, and for other corporate purposes.

A new issue of 70,000 shares of 7 per cent cumulative preferred stock (par value $100) of the Middle West

Utilities Company was offered during the week at a price to yield 6.50 per cent. The preferred stock is entitled to an additional 1 per cent dividend in any calendar year in which the total cash dividends paid on the common stock exceed $6 per share. It is also preferred as to assets and 7 per cent cumulative dividends over the common stock. Proceeds will be used to asquire new properties and for general corporate purposes.

The Gatineau Power Company made an offering of first mortgage gold bonds priced at 94 and accrued interest to yield over 5.40 per cent, a piece of financing involving a total of $25,000,000. The company is a subsidiary of the International Paper Company.

First and refunding mortgage 5 per cent gold bonds of the North Carolina Public Service Company were offered to the amount of $3,125,000 at 94½ and accrued interest, yielding over 5.37 per cent.

The Southern Cities Utilities Company, which earlier in the month entered the market with a new issue of first lien gold bonds amounting to $5,500,000, contributed $1,500,000 to the total for the week under review in the form of 6 per cent convertible gold debentures, series A. These debentures, dated April 1, 1926, and maturing April 1, 1936, were priced at 98 and interest, to yield over 6.25 per cent. The conversion conditions are worthy of note. The debentures are convertible into class B common stock up to and including Jan. 1, 1928, at the rate of $55 a share; thereafter and including Jan. 1, 1930, at $70 a share; thereafter and including Jan. 1, 1932, at $90 a share; thereafter and including Jan. 1, 1935, at $100 a share. Conversion privilege lapses after Jan. 1, 1935.

To provide funds to pay for the building of a reservoir and generating station at Rio, on the Mongaup River, transmission lines and other plant extension purposes, the Rockland Light & Power Company, Nyack, N. Y., issued a block of 6 per cent convertible cumulative preferred stock at $55 per share.

Manufacturing Companies Issue Earnings Reports

Within the past week several electrical manufacturing companies have issued statements of earnings. Net profit of $1,364,164 after depreciation, federal taxes, etc., was reported by the Allis-Chalmers Manufacturing Company for the five months ended May 31, 1926. This figure is equivalent, after allowing for dividend requirements on the 7 per cent preferred stock, to $3.42 a share earned on 257,707 outstanding shares of common stock. Profit and loss surplus on May 31 was $14,948,203, comparing with $14,259,302 on Dec. 31, 1925.

Earnings of Fairbanks, Morse & Company for the six months ended June 30, 1926, are estimated at $3.50 per share on 368,977 shares of no par common stock, after allowing for preferred dividends for the period. This figure compares with $2.74 a share actually earned in the first half of 1925.

For the quarter ended June 30, 1926, the Electric Refrigeration Corporation reports net profit of $1,673,483 after charges and federal taxes, equivalent to $2.89 a share earned on 577,446 no par shares of stock. This compares with $838,950, or $1.46 a share, on 571,250 shares outstanding in the preceding quarter and $1,236,049, or $2.16 a share, in the second quarter of 1925. Net profit for the first six months of the current year amounted to $2,512,433, against $1,809,042 for the first half of 1925, and net sales for the half year period totaled $13,921,947, as com-

Stock Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday July 20	Low 1926	High 1926
ABITIBI PWR. & PAPER, com. —no par	74	70⅛	84½
Adirondack Pwr. & Lt.—7% pf.	107	....	....
Adirondack Pwr. & Lt.—8% pf.	112½	....	....
Ala. Pwr., pf.	106	....	....
Allis-Chalmers Mfg. pf.	k110	105	110½
Allis-Chalmers Mfg., com.	88⅛	78⅛	94⅛
Aluminum Co. of Amer., com.	71	....	....
Aluminum Co. of Amer. new, pf.	101	....	....
Amer. & Foreign Pwr., pf. 25% pd.	m108	108	131
Amer. & Foreign Pwr., 7% pf.—no par	90½	89	98
Amer. & Foreign Pwr., com.—no par	21½	15½	42½
Amer. Bosch Magneto, com—no par	20⅛	16	34⅛
Amer. Brown, Boveri, Elec.	40½	30½	48⅛
Amer. Brown, Boveri, Elec., pf.	94½	86½	97½
Amer. Elec. pwr., pf.	c111	102	111
Amer. Gas & Elec., 6% pf.—no par.	93½	90½	95½
Amer. Gas & Elec., com.—no par.	94½	64	99⅛
Amer. Lt. & Trac., 6% pf.	106½	....	....
Amer. Lt. & Trac., com.	223	195	263
Amer. Pwr. & Lt., 6% pf.	97	92	97
Amer. Pwr. & Lt., com.—no par.	m 56½	50½	56½
Amer. Pub. Serv., 7% pf.	k 93	92	97½
Amer. Pub. Serv., com.	k 50	45	80
Amer. Pub. Utilities, 6% pf.	85	....	....
Amer. Pub. Utilities, 7% pf.	92	....	....
Amer. Pub. Utilities, com.	79	....	....
Amer. States Sec., A	3½	....	....
Amer. States Sec. B	2⅜	....	....
Amer. Superpwr., pf.—25	k 25½	23	26⅜
Amer. Superpower, pf.	93	....	....
Amer. Superpwr., Class A—no par.	26½	19½	37⅛
Amer. Superpwr., Class B—no par.	27⅛	21⅛	39
Amer. Wtr. Wks. & Elec., 7% pf.	k107	101	108½
Amer. Wtr. Wks. & Elec., com.—20.	63	43⅛	74
Anaconda Copper	50⅛	41⅛	51
Appalachian Pwr., 7% pf.	k 98	99	101
Appalachian Pwr., 1st pf., 7%	k 98	99	102
Appalachian Pwr., com.	k 80	80	83
Arizona Pwr., 7% pf.	70	....	....
Arkansas Cent. Pwr., pf., $7—no par	104	....	....
Arkansas Lt. & Pwr., 7% pf.	101	....	....
Arkansas Lt. & Pwr., com.	k100	110	115
Asheville Pwr. & Lt., 7% pf.	l 106½	100½	107½
Assoc. G. & E., pf.—$3.50—50	50	....	....
Assoc. Gas & Elec., pf.—$6—no par	84	....	....
Assoc. Gas & Elec., Class A—no par	33½	25½	35½
BABCOCK & WILCOX, com.	118⅛	....	....
Binghamton Lt., Ht. & Pwr., pf.	k105	105	110
Birmingham Elec. pf.—87—no par.	106	....	....
Blackstone Valley Gas & Elec., pf.	k103	103	106
Blackstone Valley G.&E., com.—50.	k 98	....	....
Blaw-Knox, com.	m 55	45	56
Brazilian Trac., Lt. & Pwr., com.	f102	....	....
Broad River Pwr., pf.	95	....	....
Brooklyn Edison, com.	142⅛	133	146⅛
Buffalo, Niagara&East.Pwr.,pf.—25.	24⅛	....	....
Buffalo, Niagara & Eastern Pwr., com.—no par	31	....	....
CALIFORNIA ELEC. GENERATING, pf.	k 93	89	95
California Ry. & Pwr., pf.	k100	88	115
Carolina Pwr. & Lt., pf.—$7—no par	106½	....	....
Cent. & S. W. Ut. 7% pf.—no par	a 94	89½	96½
Cent. & S. W. Ut., pr. In. pf.—no par	a 95½	93	100
Central Ariz. Lt. & Pwr., pf.	103	....	....
Central Ark. Ry. & Lt., 7% pf.	k 98	99	99½
Central Ill. Pub. Serv., 6% pf.	k 88	89	91
Central Ind. Pwr., 7% pf.	k 85	85	93½
Central Pwr. & Lt., pf.	98	....	....
Central States Elec., 7% pf.	92	....	....
Central States Elec., com.	m200	200	230
Century Elec., com.	m115	110	116
Chicago Fuse Mfg., com., no par...	a 31⅛	30	35
Cincinnati Gas & Elec., com.	g 89⅛	88	95
Cities Service, 6% pf.	86⅛	82⅛	86⅛
Cities Service, pf.B—10.	7⅛	7⅛	7⅛
Cities Service, pf. BB—100.	74	74	79
Cities Service, com.—20.	41⅛	37⅛	42⅛
Cities Service, Bks. Shrs.—10.	20⅛	19⅛	20⅛
Clarion River Pwr., pf.	k 93	93	95
Cleveland Elec. Illg., 6% pf.	k107½	103	108
Cleveland Elec., Illg., com.	k265	240	270
Colorado Pwr., 7% pf.	k 95	96	97
Columbia Gas & Elec., 7% pf.	115	112	115½
Columbia Gas & E., com.—no par.	84	63½	90
Columbia Ry., Gas & Elec., 6% pf.	k 90	65	96
Columbus Elec. & Pwr., 2d pf.	103	....	....
Columbus Elec. & Pwr., com.	250	....	....
Columbus Ry., Pwr. & Lt., 1st pf.	98	....	....
Columbus Ry., Pwr. & Lt., pf. B.	94	....	....
Col. Ry., Pwr. & Lt., com.—no par.	65	....	....
Commonwealth Edison, com.	a136⅛	136	145
Commonwealth Pwr., 6% pf.	k 86⅛	82	88⅛
Commonwealth Pwr., com—no par.	k 39⅛	28⅛	42⅛
Conn. Lt. & Pwr., 8% pf.	116	....	....
Conn. Lt. & Pwr., 7% pf.	108	108	113
Cons. Gas of N. Y., pf.—50.	59⅛	....	....
Cons. Gas of N.Y., com.—no par.	102⅛	87	104⅛
Cons. Gas Elec. Lt. & Pwr. of Balti., 6% pf.	104	102	105
Cons. Gas, Elec. Lt. & Pwr. of Balti. 6½% pf.	e111	108⅛	111⅛
Cons. Gas, Elec. Lt. & Pwr. of Balti. 7% pf.	e113	109	113⅛
Cons. Gas, Elec. Lt. & Pwr. of Balti. 8% pf.	e127	124	128⅛
Cons. Gas, Elec. Lt. & Pwr. of Balti. com.—no par.	e 52	45	57⅛
Cons. Pwr. & Lt., 7% pf.	105	....	....
Consumers Pwr., 6% pf.	98	....	....
Consumers Pwr., 6.6% pf.	104	....	....
Continental Gas & Elec., 7% pfc. pf	101	....	....
Continental Gas & Elec., 7% pr. pf.	97	....	....
Continental G.&E., com.—no par.	130	....	....
Croker Wheeler, com.	19	....	....
Croker Wheeler, pf.	54	....	....
DALLAS PWR. & LT., 7% pf.	106	....	....
Dayton Pwr. & Lt., 6% pf.	99	....	....
Detroit Edison, com.	134⅛	123⅛	141⅛
Dubilier Condenser & Radio, com.—no par.	m 5⅛	4⅛	11
Dubuque Elec., 6% pf.	k 94	93	98⅛
Duquesne Lt., 7% pf.	k112	111	113
EAST. N. Y. UTIL. pf.	k 93	80	85
Eastern New York Util., com.	k 65	70	75
Eastern States Power.	14	....	....
Eastern States Power, pf.	k 87	89	95
Eastern Tex. Elec., 7% pf.	103	....	....
East. Tex. Elec., com.—no par.	k 75	70	80
Edison Elec. Illum. of Boston, com.	d229½	207	250
E. Paso Elec., com.—no par.	k 70	70	94
E. Paso Elec. pf.	103	....	....
Elec. Bond & Share, 6% pf.	l 108	103⅛	109⅛
E. Bd. & Share Sec., com.—no par.	l 70⅛	56⅛	86
El. Household Util.	a 15	13⅛	25
Elec. Investors, 6% pf.—no par.	87	....	....
Elec. Investors, com.—no par.	k 42⅛	30⅛	74⅛
Elec. Investors, 10% pd. receipts.	k 20	12	56
Elec. Pwr. & Lt., ctfs. pf.	96	89½	97½
Elec. Pwr. & Lt., ctfs., 40% pd.	k105½	99⅛	115
Elec. Pwr. & Lt., ctfs. full pd.	k105	103	110½
Elec. Pwr. & Lt., ctfs., com—no par.	20½	15⅛	34½
Elec. Ry. Securities, com.—no par.	m 6	4⅛	10
Elec. Refrig.	72½	62⅛	78⅛
Elec. Storage Battery, com.—no par.	84	71⅛	86⅛
Elmira Wtr., Lt. & R. R., 7% pf.	k 99	97½	99½
Emerson Elec., pf.	m103	100	104½
Empire Dist. Elec., 6% pf.	88	82	88
Empire Power, A	24½	....	....
Engr. Pub. Serv., pf.—no par.	94	86	94½
Engr. Pub. Serv., com.—no par.	22⅛	21	29½
Eureka Vac. Cleaner, com.—no par.	54½	43	56
FAIRBANKS MORSE, pf.	k111	108½	115
Fairbanks Morse, com.—no par.	51	46	59½
Federal Lt. & Trac., com.	31	28	39½
Federal Light & Traction, pf.	87	86	89
Federal Utilities, pf.	70	....	....
Federal Utilities, com.	17	....	....
Ft. Worth Pwr. & Lt., 7% pf.	l 107	105	108½
GALVESTON-HOUSTON ELEC., 6% pf.	42	....	....
Galveston-Hstn. El., com.	13	....	....
Gen. Elec., com.	362	285	386½
Gen. Elec., special—10.	11⅛	11	11⅛
Gen. Elec., new	90⅛	79	90⅛
Gen. G.&E., (Del.) com. A no par.	37⅛	34	39
Gen. G.&E., (Del.) com. B no par.	35	28	40
Gen. G.&E., (Del.) A pf. $8 no par.	107	105½	110½
Gen. G.&E., (Del.) A pf. $7 no par.	k 98	95	99½
Gen. G.&E., (Del.) pf. B.	k 94½	92½	96
General Public Service, pf.	m106	90	106½
General Public Service, com.	m 13⅛	12⅛	16⅛
Ga. Lt., Pwr., & Rys., 6% pf.	k 94	82	96
Ga. Lt., Pwr. & Rys., com.	m 57⅛	56⅛	73⅛
Ga. Ry. & Power, 8% pf.	113	....	....
Ga. Ry. & Power, 7% pf.	103½	....	....
Ga. Ry. & Pwr., 4% pf.	k120	105	145
Ga. Ry. & Pwr., com.	120	....	....
Gt. Western Pwr., 7% pf.	k100⅛	....	....
HAVANA ELEC. UTIL., com.	m 32	28	44⅛
Havana Elec. Util., pf.	m 75	64⅛	75
IDAHO PWR., 7% pf.	k104	103	106
Ill. No. Utilities, 6% pf.	a 92	90	92
Ill. Pwr. & Lt., 7% pf.	99⅛	....	....
Ingersoll Rand	92⅛	80⅛	105
Int. Combus. Engr., com.—no par	55⅛	33⅛	64⅛
Int. Utilities, class A—no par.	k 33	31	39
Int. Utilities, class B—no par.	k 5	4⅛	9⅛
Interstate Pwr., pf., no par.	92	....	....
Interstate Pub. Serv., 7% pf.	k 97⅛	96⅛	99
Iowa Ry. & Lt., 7% pf.	k 95	98	100
JERSEY CENTRAL PWR. & LT., 7% pf.	96	....	....
Jersey Central Pwr. & Lt., pfc., pf.	k102	95⅛	105
Jersey Central Pwr. & Lt., com.—no par.	k 45	45	50
Johns-Manville, com.—no par.	147	120	165

Stock Exchange; cChicago; dSt. Louis; ePhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington, kBid, low, high, Saturday, July 17. lBid, low, high, Wednesday, July 21. mLatest quotations available.

Stock Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday July 20	Low 1926	High 1926
KANSAS CITY PWR. & LT., pf..	k112¼	107¼	112¼
Kansas Gas & Elec., 7% pf.	l 103	99	103
Kentucky Hydro-Elec., pf.	a 94½	91½	95
Kentucky Sec., 6% pf.	79	....	....
Kentucky Sec., com.	100	....	....
Kentucky Utilities, 6% pf.	92	90	95
Keystone Pwr. & Lt. 7% pf.	95	95	97
LACLEDE GAS LT., com.	k170	146	175½
Lehigh Pwr. Sec., com.—no par.	18½	10	23
Long Island Ltg., 7% pf.	108½	....	....
Long Island Ltg., com.—no par.	k115	120	150
Los Angeles Gas & Elec., 6% pf.	98½	....	....
Louisville Gas & Elec., Class. A	25½	22½	26½
MANHATTAN ELEC. SUPPLY.	84	56	87½
Manila Elec., com.—no par	33½	27½	39
Maytag Mfg., com.	23½	19	24½
Memphis Pwr. & Lt., pf., $7, no par	k105	103	107
Metro. Edison, pf.—$6—no par	93	....	....
Metropolitan Edison, pf., $7, no par.	104	....	....
Metropolitan Edison, com., no par.	k 45	45	50
Middle West Utilities, 7% pf.	a107	97½	111½
Middle West Utilities, 7% pr. lien pf.	a116	106½	123½
Middle West Utilities, com.—no par.	a114	108	134½
Midland Utilities, pr. ln. pf.	a102	98	104
Midland Utilities pf. A	a 99	96	99½
Milwaukee Elec. Ry. & Lt., 7% pf.	101	....	....
Milwaukee Elec. Ry. & Lt., 6% pf.	93	....	....
Minn. Pwr. & Lt., 7% pf.	l 103	100	104
Miss. Pwr. & Lt., pf.	105	....	....
Miss. River Pwr., 6% pf.	95	....	....
Miss. River Pwr., com.	60	....	....
Mohawk Hudson Pwr., 1st pf.—$7—no par.	101	....	....
Mohawk Hudson Pwr., 2nd pf.—$7—no par.	97	....	....
Mohawk Hudson Pwr., com.—no par	26	20½	28½
Montana Pwr., pf.	117½	112½	119½
Montana Pwr., com.	82½	69½	83½
Montreal Pwr., com.	f218½	....	....
Mountain States Pwr. pf.	97	....	....
Mountain States Pwr., com.	20	....	....
NASSAU & SUFFLOK, LTG., pf.	98½	....	....
National Carbon, pf.	a126½	125	128
National Elec. Pwr., pf.	a 94½	92	96½
National Electric Pwr-A.	a 24½	19½	26
Nat. Lt., Ht. & Pwr., com.	k 24	22	25
National Lt., Ht. & Pwr., 5% pf.	k 72	71	73
National Pwr. & Lt., pf., $7—no par.	101½	96	102½
National Pwr. & Lt., com.—no par.	23½	16½	38½
National Pub. Serv., 7% pf.	93	....	....
National Pub. Serv., ptc. pf.	109	....	....
National Pub. Serv., A com.—no par.	20½	15½	24
National Pub. Serv., B com.—no par.	16½	10	17½
Nebraska Pwr., 7% pf.	l 107	103	107½
Nevada-Calif. Elec., com.	m 25	18½	44½
New Brunswick Pwr., pf.	k 50	30	55
New England Pub. Serv., pr. ln. pf.	k 97	98	99½
New England Pub. Serv., pf.	k 89	95½	97
N. J. Pwr. & Lt., 7% pf.	k105	104	110
New Orleans Pub. Serv., 7% pf.	k102	100	102
N. Y. & Queens Elec. Lt. & Pwr., 5% pf.	87	....	....
N. Y. Central Elec., 7% pf.	k 97	98	100
Newport News & Hampton Ry., Gas & Elec., com.	k110	108	112
Newport News & Hampton Ry., Gas & Elec., pf.	k110	109	114
Niagara Falls Pwr., 7% pf.—25	28½	27½	28½
Niagara, Lock. & Ont. Pwr., 7% pf.	k108	110	111½
No. Amer., 6% pf.—50	51	49	51½
No. Amer., com.—10	53	42	67
No. Amer. Edison pf.—no par.	95½	91½	96½
No. Amer., Lt. & Pwr., pf.	101	88	104
No. American Utilities, pf., full pd.	m 94½	89	96
No. American Utilities, pf., 25% pd.	m 19	18	27
N.C. Pub. Serv., pf.—$7—no par.	92	....	....
Northeastern Pwr., com.	20½	17½	36½
No. Indiana Gas & Elec., pf. A.	102	98	103
No. N. Y. Utilities, 7% pf.	104	....	....
No. Ohio Pwr., options	15½	12	23
No. Ohio Trac. & Lt., 6% pf.	k 78	78	81
No. Ohio Trac. & Lt., 7% pf.	k 85	88	91
No. Ont. Lt. & Pwr., pf.	83	....	....
No. Ont. Lt. & Pwr., com.	k 73	45	75
No. States Pwr., 7% pf.	k101½	99½	102½
No. States Pwr. com.	104½	97	136½
No. Texas Elec., 6% pf.	45	....	....
No Texas Elec., com.	18	....	....
OHIO BRASS, com. B—no par.	k 74	70	79
Ohio Brass, pf.	k101	98	101
Ohio Gas & Elec., 7% pf.	k 94	92	95
Ohio Pwr., 6% pf.	k 95	93	96
Ohio Pub. Serv., 6% pf.	94	90	96
Ohio Pub. Serv., 7% pf.	99	....	....
Ohio River Edison, pf.	100½	....	....
Oklahoma Gas & Elec., pf.	97	....	....
PACIFIC GAS & ELEC., 6% pf..	100	....	....
Pacific Gas & Elec. com.	129½	118	132½
Pacific Pwr. & Lt., 7% pf.	l101	98	102½
Parr Shoals Pwr., 6% pf.	k 92	....	....
Penn Central Lt & Pwr., pf.—no par	c 72½	71	91
Penn-Ohio Edison, 7% pf.	95½	....	....
Penn-Ohio Elec., 7% pf.	94	93	96
Penn-Ohio Pwr. & Lt., 7% pf.	96½	94	97
Penn-Ohio Pwr. & Lt., 8% pf.	k107	100	106
Penn Pwr. & Lt.—$7—no par.	l 107	103	108½
Penn Pub. Serv., 7% pf.	k101	96	103
Penn Pub. Serv., 6% pf.	k 85	85	90
Penn Wtr. & Pwr., com.	c 153	141	171
Phila. Co., 6% pf.—50	c 50½	48½	50½
Phila. Co., com.—50	k 72	59½	76½
Phila. Elec., com.—25	m 50½	41½	67½
Pittsburgh Utilities, pf.—10	k 17	14½	20½
Portland Elec. Pwr., 7% pf.	97	....	....
Portland Elec. Pwr., 6% pf.	80	....	....
Portland Elec. Pwr., 6% 2nd pf.	74	....	....
Portland Elec. Pwr., com.	34	....	....
Potomac Elec. Pwr., pf.	j108	....	....
Pwr. Corp. of N.Y., com—no par.	m 79	77½	90½
Pwr. Sec., pf.—no par.	k 10	10	29
Pwr. Sec., com.—no par.	k 4	4	13
Pub. Serv. of N. J., 7% pf.	k109½	103½	109½
Pub. Serv. of N. J., 8% pf.	120½	115	121
Pub. Serv. of N. J., com.—no par.	89½	72	92½
Pub. Serv. of No. Ill., 6% pf.	a106	100½	106
Public Serv. of No. Ill., 7% pf.	m116½	112	116½
Pub. Serv. of No. Ill., com.—no par	a137½	128½	140
Pub. Serv. of No. Ill., com.	k127	126	135
Pub. Serv. of Okla., 7% pf.	k 94	92	95
Pub. Serv. Elec. & Gas, 6% pf.	k102	97	102½
Public Service Elec. Pwr., pf.	k111½	106	112½
Puget Sound Pwr. & Lt., 7% pf.	102	....	....
Puget Sound Pwr. & Lt., 6% pf.	83	....	....
Puget Sound Pwr., & Lt., com.	29	28	66½
RADIO CORP. OF AM., pf.—50	48	44½	48½
Radio Corp. of Amer., com.—no par.	43½	32	48½
Republic Ry. & Lt., pf.	106	....	....
Republic Ry. & Lt., com.	82	....	....
Rochester Gas & Elec., 5% pf.	k 95	80	98
Rochester Gas & Elec., 6% pf.	102	....	....
Rochester Gas & Elec., 7% pf.	k105	105	107
SAN JOAQUIN LT. & PWR., 7% pf.	k 97	97½	98½
Safety Cable	52½	42½	54½
St. Joseph Ry., Lt., Ht. & Pwr., pf.	k 67	60	70
Servel Corp., new	22½	21½	22½
Sierra Pacific Elec., com.	27½	....	....
Sioux City Gas & Elec., 7% pf.	100	....	....
S. E. Pwr. & Lt., pf.—$7—no par.	99½	....	....
Southeastern Pwr. & Lt., ptc. pf.	65½	60	67½
S. E. Pwr. & Lt., com.—no par.	28½	20	46½
So. Calif. Edison, 8% pf.—25	k 32½	32½	33½
So. Calif. Edison, 7% pf.—25	k 27½	27½	28
So. Calif. Edison, 6% pf.—25	k 24½	24½	25
So. Calif. Edison, com.	32½	30½	33
Southern Cities Utilities, 7% pf.	89	....	....
Southern Cities Utilities, com.	39	28	49
Southwestern Lt. & Pwr., A.	60	....	....
Southwestern Lt. & Pwr., B.	60	....	....
Southwestern Lt. & Pwr., $6 pf.	82	....	....
Southwestern Pwr. & Lt., 7% pf.	101	....	....
Springfield (Mo.) Ry & Lt., 7% pf.	k 98	95	100
Standard Gas & Elec., 8% pf.	56½	53½	57½
Standard Gas & Elec., 7% pf.	102	....	....
Standard Gas & Elec., com.—no par.	55	51	69
Standard Pwr. & Lt., 7% pf.	94½	....	....
Staten Island Edison, pf.—$6—no par	95½	....	....
Superheater, com.—no par.	157	....	....
Syracuse Lighting, 7% pf.	k102	105	107
Syracuse Lighting, 8% pf.	k115	....	....
Syracuse Lighting, com.	k330	260	335
TAMPA ELEC., com.	50½	48	87
Tenn. Elec. Pwr., 6% pf.	88	....	....
Tenn. Elec. Pwr., 7% pf.	102	....	....
Terre Haute, Ind. & East Trac., pf.	k 20	20	37
Terre Haute, Ind. & East Trac., com	k 1	1	7
Tex. Pwr. & Lt., 7% pf.	l105½	102	106½
Tide Water Pwr., 8% pf.	103	....	....
Timken Roller Bearing, com—no par	55½	44½	56½
Toledo Edison, 8% pf.	113	111	113
Toledo Edison, 7% pf.	101½	101	103
Toledo Edison 6 pf.	94	90	95
Toledo Edison, com.	k100	....	....
Tri-City Ry. & Lt., 6% pf.	k 88	87½	89
UNITED GAS & ELEC., 6% pf..	95½	....	....
United Gas & Elec., com.—no par..	m 57	56	66
United Gas & Elec. (N.J.), 5% pf....	68	....	....
United Gas Impr.—50	c114½	84½	144½
United Lt. & Pwr., pf.—$4—no par.	a 51	42½	51
United L. & P. pf.—$6.50—no par...	a 87½	81½	92
United Lt. & Pwr., com., A—no par	16½	12½	28
United Lt. & Pwr., com., B—no par	a 20½	15	31
Utah Pwr. & Lt., 7% pf.	l102½	99	103½
Utica Gas & Elec., 7% pf.	104½	....	....
Utica Gas & Elec., com.	k200	....	....
Utilities Pwr., & Lt., 7% pf.	92	....	....
Utilities Pwr. & Lt., com A.	29½	28½	37
Utilities Pwr. & Lt., com. B—no par.	14½	14	18½
VERMONT HYDRO - ELEC., 7% pf.	k 94½	94	96
Virginia Elec. & Pwr., 7% pf.	k104	101	105
Virginia Pwr., 7% pf.	k108	102	104
Virginian Pwr., com.	k 70	65	75
WAGNER ELEC., pf.	b 65½	65½	85
Wagner Elec., com.—no par.	b 20	20	34½
Washington Ry. & Elec., com.	j180	....	....
Washington Ry. & Elec., pf.	j 88½	....	....
Washington Wtr. Pwr., com.	k134	130	136
West Mo. Pwr., 7% pf.	94	....	....
West Penn., 7% pf., temp. ctfs.	m100	95½	101
West Penn, com.	m125	118	130
West Penn Elec., pf.	k100½	95½	100½
West Penn Elec., Class A,	97	88½	97
West Penn Pwr., pf.	k109½	108	112
West Va. Lt., Ht. & Pwr., 7% pf...	k 95	95	98
West Va. Utilities, 7% pf.—50	k 45	43	48
Western Pwr., 7% pf.	94	....	....
Western States Gas & Elec., 7% pf.	92½	....	....
Western States Gas & Elec., com.	16	....	....
Westinghouse El. & Mfg., com—50.	70½	65	79½
Weston Elec. Instrument, Class A..	31½	27½	32½
Weston Elec. Instrument, com.	17	13½	19
Wheeling Elec., pf.	k 96	91	97
Wis. Pwr., Lt. & Ht., 7% pf.	k 90	85	90
Worthington Pump, pf. A	k 70	67½	80
Worthington Pump, pf. B	k 58	53	65
Worthington Pump, com.	29½	20½	44½
YADKIN RIVER PWR., 7% pf...	l106½	102	107½
Yale & Towne, com.—25	68	60½	69

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington. *k*Bid, low, high, Saturday, July 17. *l*Bid, low, high, Wednesday, July 21. *m*Latest quotations available.

pared with $9,462,476 for the similar period of 1925.

The Manhattan Electrical Supply Company, Inc., and subsidiaries for the six months ended June 30, 1926, report net profit of $856,234 after taxes and depreciation equal to $10.57 a share earned on 81,000 shares of no par stock. This compares with $164,413, or $2.03 a share, figured on the present share basis, in the first half of 1925.

California Edison Stockholders Reach 100,000 Mark. — Stockholders of the Southern California Edison Company now total more than 100,000. The quota of approximately 5,200 necessary to score the 100,000 mark was completed in June by members of the Edison company organization during what was designated as the "R. H. Ballard one-hundred-thousand-stockholder week," in honor of the executive vice-president and general manager of the company, who had placed July, 1926, as about the time the 100,000 objective would be reached. The company now has one stockholder to every five families in the community of 2,250,000 people served. Of its stockholders 90 per cent reside within its service territory and are consumers of its electric product.

New Canadian Issues.—The Avon River Power Company, Ltd., has issued first mortgage 5½ per cent sinking fund gold bonds to the amount of $650,000, the price being 98½ and accrued interest, to yield over 5.60 per cent. These bonds, series A, are dated July 1, 1926, and mature July 1, 1956. The Avon River Power Company, Ltd., owns and operates the hydro-electric power plant on the Avon River, Nova Scotia, with a capacity of 2,600 hp. The development of its second power site, 2 miles further up the river, is now being proceeded with and on its completion the company will have a total installation on the Avon River of approximately 5,600 hp. On July 1 the company acquired all the properties of the Gaspereaux River Light, Heat & Power Company, Ltd., including its development on the Gaspereaux River of 1,100 hp. The Avon River Power Company, Ltd., also owns the plants and properties of the Windsor Electric Light & Power Company, Ltd. The Quebec Southern Power Corporation has issued 6½ per cent first mortgage and collateral trust twenty-year sinking fund gold bonds at 99 and accrued interest, yielding about 6.60 per cent. The Quebec Southern Power Corporation is an amalgamation of three hydro-electric properties in the Laurentian district of Quebec and these additional bonds are being offered to complete purchase of properties, to make further extension and to provide working capital.

Southeastern Power Increases Capital. — At the annual meeting of the stockholders of the Southeastern Power & Light Company held July 14 an increase in the capital stock was authorized from 4,850,000 shares of no par value (consisting of 100,000 shares of $7 cumulative preferred stock, 100,000 shares of $6 cumulative preferred stock,

650,000 shares of participating preferred stock and 4,000,000 shares of common stock) to 7,000,000 shares of no par volue. The present set-up of the company consists of 750,000 shares of $7 cumulative preferred stock, 250,000 shares of $6 cumulative preferred stock, 1,000,000 shares of participating preferred stock and 5,000,000 shares of common stock.

Puget Sound Company Omits Common Dividend.—Directors of the Puget Sound Power & Light Company on June 28 voted to omit the quarterly dividend of $1 per share usually paid in July on the outstanding common stock, no par value. The quarterly dividends on the prior preference and preferred stocks were declared. The company issued a statement to the effect that facilities are available to do a considerably increased volume of business with relatively little additional investment and expense. The present capacity of the recently completed Baker River plant is sufficient to supply a considerable amount of new business in addition to replacing with its water power the large amount of steam and purchased power which the company was obliged to provide last year at a cost of more than $1,000,000, due in part to the occurrence of the most severe drought of record in the district. The omission of the dividend on the common stock, which will conserve cash resources at the rate of over $800,000 annually, the growth and improvement of the business when realized, and the economies from the operation of the Baker River plant will greatly strengthen the position of the preferred stocks and the intrinsic value of the common stock by the increase in reserves and the resulting increase in the strength of the company's credit.

American States Securities Elects Directors.—At the first annual meeting of the American States Securities Corporation held at Wilmington, Del., the following were elected directors of the corporation for the ensuing year: Clayton E. Platt, Philadelphia; H. L. Nason, Boston; Howard F. McConnell, New York; Russell J. Boyle, Grand Rapids, and Frank T. Hulswit. The following have been elected officers of the corporation by the new board of directors: President, Frank T. Hulswit; senior vice-president, H. L. Nason; vice-president and treasurer, H. M. Pleune; secretary, George W. Saam. The organization has a substantial investment in the securities of the United Light & Power Company, American Superpower Corporation, Commonwealth Power Corporation, National Power & Light Company, Long Island Lighting Company, Electric Investors, Inc., and other utility companies.

Montreal Utility to Split Shares.—Directors of the Montreal Light, Heat & Power Consolidated have decided, with the approval of the shareholders, to split the present shares four to one. If the shareholders ratify the plan when they meet July 26 each holder of one share of common will receive one new 6 per cent preferred share with a par value of $50 plus three new common shares of no par value. The split-up will allow the company to inaugurate a customer-ownership campaign, in which there will be sold a limited amount of the new common stock to customers at preferential prices. The unusual plan of offering its customers shares that will participate in increased future profits has caused some comment, for in most cases public utilities wishing to distribute their shares among customers sell preferred stock. The new common stock will be sold at a preferential price to employees of the company also. This change marks the first split-up of the shares of the Montreal Light, Heat & Power Consolidated. In 1916 the Civic Investment & Industrial Company was incorporated to acquire the Montreal Light, Heat & Power Company and the Cedar Rapids Power Company. The holders of the Montreal stock received three shares in the new company for every one in the old, while the Cedar Rapids shareholders received share for share. The name of the merger company was not changed until 1918.

Customer Sales Reach $18,850,000 in May

Based upon monthly reports received by the ELECTRICAL WORLD from electric light and power companies selling stock direct to their customers and employees, it is estimated that during May a total of 268,000 shares were sold in this manner. The value of the stock sold is estimated at $18,850,000. A total of 31,700 customers took part in the sales during May.

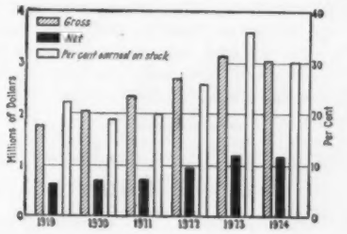
Worcester Utility Shares Prosperity

Decision to Give Customers Big Rebate in October Calls Attention to Company's Long Record of Dividend Disbursements

BY PAUL WILLARD GARRETT
Financial Editor *New York Evening Post*

ONE of the smaller of the country's power and light companies to come into the limelight lately is the Worcester Electric Light Company, from the facts that (1) it has just declared a 30 per cent extra dividend to its stockholders, (2) announced a 50 per cent cut in all customers' (except those to other utility companies) bills for October and (3) steps have been taken to merge the Worcester Electric Light Company and the Worcester Gas Light Company.

Not many utility companies in the country, large or small, can show so good a dividend record as the Worcester Electric Light Company. For nearly a quarter of a century this utility has been paying dividends of substantial proportions to its stockholders, which it has been able to do as a result of its conservative capitalization and able management. The capital structure of the present company is free from funded debt and reveals only one class of outstanding stock. Capital stock is authorized to the amount of $2,400,000, all of which is outstanding. The par value is $25, having been changed from $100 in April, 1925, when four new shares were issued for each share of old stock.



EARNINGS OF WORCESTER ELECTRIC LIGHT COMPANY SINCE 1919

Dividend payments made on $100 stock reveal an extraordinary earning ability for the company. The payments over a period of years have been as follows: In 1903 dividends aggregated 18 per cent, in 1904 to 1907 inclusive they were at the rate of 8 per cent annually, in 1908 they were 11½ per cent, in 1909 to 1913 inclusive 10 per cent annually, in 1914 they were 15 per cent, in 1915 they were 12 per cent, in 1916 dividends totaled 22 per cent, in 1917 they were 12, in 1918 again 12, in 1919 dividends were 12 per cent plus an 11 per cent extra dividend paid in Liberty bonds, in 1920 they were 12 per cent plus an extra dividend of 9.28 per cent, in 1921 to 1923 inclusive 12 per cent plus 8 per cent extra and in 1924 they were 12 per cent (including 3 per cent paid Jan. 3, 1925) plus 10 per cent extra.

Payment of a 30 per cent extra dividend to stockholders of record June 30 (payable on July 12), and involving $720,000, means that the Worcester Electric Light Company dividends for the year aggregate the extraordinary total of 46 per cent.

That the company wants its customers to share in its prosperity is revealed in the recent action to allow a 50 per cent rebate on October bills. This rebate, it is reckoned, will affect 45,000 customers and will lighten their electric bills for that month by roughly $136,000. The city of Worcester alone will benefit by the plan to the extent of about $10,300 from a saving in charges on street and public building service.

Subject to the approval of the stockholders of the two companies, the Worcester Electric Light and the Worcester Gas Light companies will be merged. The two boards of directors have agreed that the exchange of stock may be made on the basis of one share of the Worcester Electric Light Company stock for each 2½ shares of the common stock of the gas company. The gas company has outstanding 82,000 shares of its $25 par value stock, or $2,050,000, for which will be given 32,800 shares of the electric light company stock of a par value of $820,000.

Manufacturing and Markets

Jobbers Recommend Simplification

Suggest Line of Fans Be Further Reduced and Stocks of Conduit Lessened by Furnishing One Finish Only—Underwriters' Label Recommended for Heating Devices

SEVERAL recommendations made by various committees of the Electrical Supply Jobbers' Association at its recent meeting deal with matters of interest to manufacturers. A recommendation was made that conduit and conduit fittings should be furnished and used only in one finish and that finish should be the one approved by the proper bodies as being the safest, the most lasting and the most economical.

FAN SIMPLIFICATIONS

The committee on fan motors felt that the success of the Society for Electrical Development in its educational campaign on electric refrigeration might well be emulated by the fan manufacturers in their campaign on ventilation. This committee also reviewed the situation which has developed since its recommendation some time ago to discontinue the 16-in. non-oscillating fan and commented favorably on the results. Considering the fan situation further the committee felt that it would be in the best interests of the association if the Bureau of Simplified Practice of the Department of Commerce would study the advisability of recommending that the 12-in. oscillating fan be discontinued and also that at least one size in the 8-in., 9-in. and 10-in. group be discontinued.

Recommendations on lighting fixtures and reflectors cover commercial units, and the committee believes that the manufacturers could standardize on holders of 4-in., 6-in. and 8-in. types only, and the manufacturers of commercial glassware of the inclosed types could standardize on 9-in., 12-in., 14-in., 16-in. and 18-in. sizes.

In view of the Underwriters' present specifications on wires and cords it is found very difficult to wire fixtures, brackets, portables, floor lamps, etc., using code wires, and cords, with $\frac{1}{8}$-in. sockets. It is, therefore, suggested by the committee that fixtures and wiring device manufacturers consider the economy of discontinuing the $\frac{1}{8}$-in. and standardizing on the $\frac{1}{4}$-in. socket. It is thought that by such standardization it would be possible to discontinue also the $\frac{3}{8}$-in. socket for general fixture use.

UNDERWRITERS' LABEL ON APPLIANCES

The heating devices committee recommends that manufacturers of heating devices avail themselves of Underwriters Laboratories' label service on all their products as a means of improving the standard of such products and as a protection to the public against many heating devices now on the market which when operated prove to be a serious physical and fire hazard. As a means of further safeguarding the public it is suggested that the manufacturers give wide national publicity to the fact that such insurance of safety in operation is provided only on heating devices which are placed on the market bearing the Fire Underwriters' label of approval.

The members of the committee on radio feel that the transportation expense on radio merchandise, especially to points far distant from the source of supply, is a burden that they should not be called upon to carry, and recommends that all manufacturers arrange to make an equitable freight allowance on radio merchandise. The committee further recommends that all defective goods should be rectified by the manufacturers either by reimbursement of jobber for service work or allow the return of the defective material for full credit, including transportation both ways.

It is also recommended that manufacturers consider announcing their new models in the late spring or early summer so as to give the jobber the opportunity of introducing the line and getting some volume of business during the summer months, and that radio tubes be packed in cartons of such character that the tube can be tested without removing it from the carton.

Sales Statistics on Direct-Current Motors

Orders entered for direct-current motors during the month of May showed a falling off of 14½ per cent as compared with the previous month. Sales and billings for the first five months of 1926 are shown in the accompanying table and include control equipment sold with the motors. The figures for the first three months have been revised and do not agree with those previously published.

ORDERS ENTERED AND SALES BILLED FOR DIRECT-CURRENT MOTORS

(1-hp. to 200-hp. inclusive, built in general-purpose motor frames, including control equipment sold with motors.)

(Issued by Electric Power Club.)

Month, 1926	Orders Entered	Billings
January	$815,976.75*	$934,124.01*
February	878,028.36*	807,281.31*
March	1,167,748.91*	1,027,318.84*
April	866,858.52	821,946.62
May	740,231.54	793,832.28
Year to date	$4,468,854.08	$4,384,503.06

*Corrections in these figures made by a member company.

Electric Industrial Trucks and Tractors

June shipments of electric industrial trucks and tractors, as reported to the Department of Commerce by the nine leading manufacturers in the industry, were 144, as compared with 108 in the month of May.

SHIPMENTS OF ELECTRIC INDUSTRIAL TRUCKS AND TRACTORS

	Domestic		
1925	Tractors	All Other Types	Exports
Quarter ended:			
March 31	45	259	41
June 30	49	280	50
Sept. 30	57	286	12
Dec. 31	41	295	25
Total	192	1 120	128
1926			
Quarter ended,			
March 31	47	310	17
June 30	50	281	32
January	21	86	4
February	15	96	5
March	11	128	8
April	17	90	4
May	12	87	9
June	21	104	19

The accompanying table shows the detailed figures by quarters since the beginning of 1925 and by months from January, 1926.

Selling Function in the Refrigerator Field

Some jobbers have asked if they will be accorded a position in the sale of domestic refrigerators and criticisms of manufacturers' resale men by utility companies have raised a question regarding their proper function. G. M. Dwelley, sales manager of the Kelvinator Corporation, during a recent discussion of the subject in St. Paul, Minn., gave an answer to the question. It is that jobbers will have a definite and valuable function if they serve as more than a financing and warehousing organization. They must equip themselves to handle servicing and must distribute merchandising helps to dealers, in Mr. Dwelley's opinion.

Manufacturers' resale men have been commended for the number of sales they make of appliances, but considerable criticism has been voiced by utility companies regarding the many reverts resulting from such sales. This criticism is not directed alone at manufacturers' resale men, but at any high-pressure salesmen whose main object is to sell a large quantity of any device. It is recognized by the critics that the results depend to a great extent on supervision and on the form of remuneration. The suggestion has been made by C. O. Dunten, commercial manager of the Central Illinois Public Service Company of Springfield, Ill., that manufacturers' resale men be employed for demonstrations and training

of utility or dealer salesmen, but not used to sell direct to the public, except where no other procedure is open. It was also brought out at the discussion that manufacturers' resale men will be satisfactory from all points of view if permanent crews are established in different territories and floating crews are discontinued for direct selling to the public.

Business Conditions

ELECTRICAL men continue to feel quite optimistic regarding the business being transacted. Industrial plants are steady buyers in the market and are helping to maintain the volume of sales. Contracts for two large turbo-generator units, one of 60,000-kva. capacity and the other of 75,000-kva. capacity, are expected to be closed in the next few days, and orders for several large industrial projects are pending. Cable manufacturers are busy filling orders and in many cases they report their plants are operating at capacity.

In New England sales are holding up in good volume, although there is a temporary lull in the demand for large industrial equipment. Inquiries for turbo-generators continue active, and sales of new construction material are very encouraging. Industrial plants are active buyers in the New York district and there is a strong demand for motors and control equipment. Central-station buying is spotty, and although several projects of considerable proportions are under discussion sales are apparently confined to maintenance equipment. In the Southeast the demand is quiet, but a good volume of orders is anticipated in the near future. There is a considerable amount of "white way" equipment business in prospect. Large power companies continue to make heavy purchases of line construction materials and some difficulty is being experienced in obtaining poles to keep up with construction programs. A steady volume of sales is noted in the St. Louis district and business is considered very satisfactory, with no marked depression in any particular spot. The contract for auxiliary switching equipment for extensions to a large power station is reported closed and amounts to about $90,000. Evidence of prosperity is noted in the Middle West and the volume of business is increasing. The various utility companies are actively purchasing maintenance equipment and are busy with construction work. On the Pacific Coast spotty conditions prevail with an aggregate good volume of business.

Non-Ferrous Metals Continue in Active Demand

The activity in non-ferrous metals, particularly copper, received considerable impetus last week and has continued. Copper was again the leader and apparently the 14¼-cent level for Eastern delivery has been fairly well established. Lead buying continues unabated, with the price, if anything, firmer than a week ago. Zinc showed a tendency to sag, but traders and speculative buyers have entered the market and the position seems stronger today. Though the aggregate sales for the week ended Wednesday are considerably under the exceptionally high figure of the previous week, an excellent business was transacted each day since last week Wednesday with the exception of Saturday. Until today large tonnages were traded at 14.175 cents in the East, whereas at the same time other sellers were getting 14.20 cents and 14¼ cents in the East and 14.375 cents in the Middle West. One or two big buyers have placed large orders for October delivery at 14¼ cents, while the lower figures quoted were principally for August and August-September positions.

NEW YORK METAL MARKET PRICES

	July 14, 1926 Cents per Pound	July 21, 1926 Cents per Pound
Copper, electrolytic	13.95–14	14¼
Lead, Am. S. & R. price	8¼	8¼
Antimony	13¼-14	14½
Nickel, ingot	35	35
Zinc spots	7.90	7.475
Tin, Straits	63¼	63¾
Aluminum, 99 per cent.	28	27½

Base copper price July 21, 1926, 16 cents.

Though London prices for lead have steadily advanced, no further increase has been made by the leading seller in the New York market. The American Smelting & Refining Company continues its contract price at 8¼ cents, New York, and this price has also been obtained by other sellers. The demand seems to have been greater in the Middle West than in the East. The lead market may be characterized as firm and active, with some producers practically sold out of early positions, but with others holding sufficient stocks so that consumers need feel no alarm about supplies. Tin prices have continued about the same as they were a week ago, with nearby Straits commanding slightly above 63 cents and discounts of ⅛ cent to ¼ cent being made for forward positions. Traders have been active in the zinc market, though the demand on the part of consumers, especially brass makers, has been up to the average.

Steady Volume of Sales Noted in the St. Louis District

Business conditions in the St. Louis district are reported by jobbers and manufacturers as very satisfactory. Sales are in steady volume, with no marked depression in any particular spot. The past week has shown great activity in fans and domestic refrigerating machines, especially the latter. Some dealers claim to have sold more than three times as many of the house type of electric refrigerators this year as last year up to the same date, and are continuing to do so. The closing of a contract for auxiliary switching equipment for extension to a large power station is reported. Thirty panels of the truck type will be installed and the contract price is in the neighborhood of $90,000. A transmission line carrying 110,000 volts is to be built this fall, connecting a group of electric properties in southeast Missouri and northeast Arkansas with the Memphis distribution system.

Industrial Plants Active Buyers in the New York District

There is a strong demand for motors and control equipment among industrial buyers in the New York district, but there has been a decrease in sales of motors for electric household refrigerators, pumps and similar apparatus. Although the past few days has seen an increasing demand for fans, these have been supplied from retailers and jobbers' stocks, and due to the lateness of the season, practically no increase in sales of fan motors is reported by manufacturers. Sales of circuit breakers have fallen off considerably, but a large volume of inquiries for this equipment is being received, and it is expected that this slump will be only of short duration. Central-station buying is spotty, and although several projects of considerable proportions are under discussion, sales are apparently confined to maintenance equipment. Line hardware and cross-arms are the most active materials in the Central-station field at present, with a considerable demand apparent for distribution transformers and meters.

Demand Quiet in Southeast—Good Volume Anticipated Soon

Business in the Southeast, while quieter than for some weeks past, is maintaining the level of the same period last year. There seems to be a temporary lull in purchases of materials for large industrial and commercial construction, but a good volume of orders is anticipated in the immediate future. An order was received from Florida for "white-way" equipment for a 300-post installation. There is a considerable amount of "white-way" equipment business in prospect and jobbers anticipate good orders within the coming month. Residential and commercial lighting fixtures continue in good demand, two very satisfactory orders being received last week from Georgia cities. Wiring material sales will be boosted by the letting next week of a contract for $20,000 worth of wiring supplies to be used in the construction of a hotel in Savannah.

Large power companies continue to make heavy purchases of line construction materials and some difficulty is being experienced in obtaining poles required to keep up with the construction programs. Other materials are coming through satisfactorily. Transformers are in good demand, one order amounting to $75,000 being received recently from the Carolinas, and in addition to this large order, several satisfactory smaller orders are reported. Substation equipment continues in active demand and one manufacturer reports the receipt of orders covering six complete small stations for south Georgia. Sales of outdoor switching equipment are also reported reasonably active. Purchases by small central-station companies and municipalities

are somewhat off, there being a tendency in some sections to hold off maintenance work pending negotiations looking toward the sale of these small systems.

Sales in New England Hold Up in Good Volume

Trade trends in the New England district, as reported by a number of prominent manufacturers, show a temporary lull in the demand for large industrial equipment, pronounced activity in the movement of general supples and new construction material and an increased demand for transformers. While orders for large equipment have decreased during the past week, on the other hand, inquiries for turbo-generators continue active. One manufacturer records the recent receipt of four sets of specifications for this type of equipment, and in addition, a number of negotiations for units of exceptional interest are exp cted to be closed shortly. Sales of new construction material, consisting of wire, cable and hardware, are encouraging. A manufacturer reports a marked increase in the movement of this material during the past week and another notes a steady turnover, averaging about five cars per week of general supplies, much of which is being sold for light and power line extensions in newly developed areas. As compared with last year, this trend at this time appears stronger and will continue in good volume on account of the high level of building contracts.

Small motor sales are steady; transformers are in good demand, especially the distribution type, of which a number of sales were recorded. Insulators are moving well, though in small lot orders. Regulators and meters are in steady demand. Household appliance sales are reported in good volume. It is interesting to note that sales for the past week, reported by one group of central-station companies, continue to maintain the level of last year. In the opinion of a prominent manufacturer, the suitability of household appliances for summer use is being keenly appreciated and is reflected in a strong trend in sales. Sales of radio equipment are less active, but stocking up of supplies by jobbers has already begun.

Volume of Sales Satisfactory in Middle West

Business in the Middle West continues on a satisfactory basis. Evidence of prosperity is noted from various sources. Reports of building and traffic show unusual activity as viewed with previous years, and the volume of business is increasing steadily. Apparently there is no decrease in building construction work in sight, and indications point to continued activity. Reports from cable manufacturers show that plants are operating at capacity. Some companies state that business shows an 8 per cent increase over last year, which was admittedly a good year. The various utility companies are busy with a certain amount of construction work and maintenance purchases are quite heavy. There has been a good demand for distribution transformers, meters, pole line hardware and insulators. Jobbers report good business. Appliance sales are holding up well, with a particularly good demand noted for washing machines, one jobber placing an order for 450 machines this week. Fans have moved more readily and there has been an excellent demand for electric irons.

Business Spotty on Pacific Coast —Aggregate Volume Good

Spotty conditions prevail on the Pacific Coast with an aggregate good volume of business. A large manufacturer reports sales as being comparatively small with no outstanding orders, while another company states that a few good orders were booked. Sales include a 1,500-hp. speed set for a steel mill costing about $40,000, $10,000 worth of switching equipment for a San José substation, 15 motors of from 35 hp. to 50 hp. for oil drilling, which, together with transformers, control apparatus and supplies, totals about $30,000. Railroad orders include $25,000 worth of telephone cable and 5,000 dry batteries. Power company purchases have covered 100 line switches for 7,500-volt service and 250 poles 5 in. and 9 in. square sawed 20 ft. long. Miscellaneous orders call for $5,000 worth of supplies for a new lumber plant in the Fort Bragg district and $6,000 worth of strand cable rings and cable for a Los Gatos telephone plant.

Activities of the Trade

Western Electric Orders for Six Months Show Increase

Orders received by the Western Electric Company for the six months ended June 30 amounted to 123,712,000 and compares with $120,150,000 for the same period last year. Sales for the six months ended June 30 are reported by the company as amounting to $123,856,000, compared with $115,046,000 for the same period in 1925. Orders on hand at the end of the six months period amounted to $90,675,000, while on the same date last year orders on hand amounted to $90,640,000.

Westinghouse Gets Order for Waterwheel Generators

Two 45,000-kva. waterwheel generators have been ordered from the Westinghouse Electric & Manufacturing Company by the Southern California Edison Company for installation in the No. 1 and No. 2 units in that company's Big Creek 2-A station. These two units are said to set a record as the largest horizontal waterwheel generators ever built. The two units will be totally inclosed and will be complete with direct-connected exciters and usual accessories. The total weight of each unit will be about 600,000 lb., the over-all width and height being respectively approximately 25 ft. and 23 ft. The length of the generator itself will be about 14 ft.

Edison Electric Appliance Obtains Additional Plant Facilities

The Edison Electric Appliance Company, Inc., has purchased a six-story fireproof building at 1910 S. 52d Avenue, Chicago, to take care of its rapidly increasing business. This building will add 200,000 sq.ft. of floor space or 50 per cent to the present manufacturing facilities. Bookings of Hotpoint electric appliances for the first six months of 1926 are reported as over 50 per cent ahead of those last year for the same period and the company states that the acquisition of this additional plant capacity was necessary to meet sales requirements.

In addition to the building on 52d Avenue five acres of land were purchased for additional buildings as needed. Five acres of land were also purchased west of the Chicago plant at 5600 West Taylor street. The company states that its business has been rapidly increasing for the past twelve months owing to the rapid spread in the popularity of household electric appliances and hotel and restaurant electric cooking equipment.

The Graybar Electric Company announces that new offices and warehouse for the Omaha (Neb.) branch of the company will be occupied on Nov. 1. The new quarters, consisting of a two-story structure and basement, will be at 1122 Capital Avenue and will have 19,860 sq.ft. of floor space. The company also states that a new branch office and warehouse was opened on July 1 at Asheville, N. C., at Commerce and Buncombe Streets. H. H. Hix, formerly of the Atlanta, Ga., branch of the company, will be in charge at Asheville.

The Absolute Con-tac-tor Corporation, Beloit, Wis., manufacturer of mercury switches, pressure switches, etc., has let the contract for the construction of a new fireproof factory building at Elkhart, Ind.

B. A. Behrend, consulting engineer, formerly at 85 Devonshire Street, Boston, announces the removal of his office and laboratory to 110 Cliff Road, Wellesley Hills, Mass.

The Cutler-Hammer Manufacturing Company, manufacturer of electric controlling devices, announces that B. M. Horter, formerly of the Philadelphia office, has just been appointed manager of the Boston office, succeeding J. M. Fernald, who has resigned. Mr. Horter has been with the Cutler-Hammer company since March, 1916.

The Electric Household Utilities Corporation, 600 West Jackson Boulevard, Chicago, formerly the Hurley Machine Company, manufacturer of "Thor" washers, ironers and vacuum cleaners, announces the appointment of E. S. Ridgway as general sales manager. Mr.

Ridgway was formerly vice-president and general manager of the Utensils Company of Fort Wayne, Ind.

The Fullman Manufacturing Company, 1209 Jefferson Street, Latrobe, Pa., manufacturer of "Latrobe" floor boxes and "Gem" insulator clamps, announces the appointment of C. H. Vander Bloom, 1398 Union Trust Building, Cleveland, as its sales representative for the states of Ohio, West Virginia and Kentucky and the city of Erie, Pa.

Copeland Products, Inc., Detroit, announces a new low-priced model electric refrigerator in which the entire mechanism, including the freezer, is contained in one compact unit which is removable so that another element can readily be substituted if desired.

The Rutenber Electric Company, Marion, Ind., manufacturer of electric appliances, announces that J. S. Colt has been appointed Southeastern district sales manager with headquarters at Washington, D. C.

The Westinghouse Electric & Manufacturing Company has appointed J. R. Hauser in charge of its Terre Haute, Ind., office, succeeding J. L. Gaston, who has been transferred to Chicago. Mr. Hauser was formerly with the Cincinnati branch of the company.

The Habirshaw Cable & Wire Corporation, 10 East 43d Street, New York, announces the appointment of William H. Lipscomb, formerly with the United States Steel Corporation, as president, succeeding John S. Worley, vice-president and general manager, who has resigned.

Harold E. Trent, 259 North Lawrence Street, Philadelphia, announces the addition of 10-lb. and 20-lb. capacity pots to its line of melting pots. The pots are adapted for operation either on 110 volts or 220 volts.

The Cooper Hewitt Electric Company, 95 River Street, Hoboken, N. J., manufacturer of mercury-vapor lamps, etc., has plans under way for a six-story addition to its plant, 100 ft. x 425 ft.

The Graybar Electric Company announces the appointment of R. A. Stoner to succeed the late E. D. Frisbie as head of the company's Scranton, Pa., sales office at 718 Connell Building. For the past two years Mr. Stoner has been power apparatus specialist for the company at the Philadelphia branch.

The Westinghouse Electric & Manufacturing Company has recently sold to the Solvay Process Company, Syracuse, N. Y., two turbo-generator units, each rated at 5,000 kva. The turbines will operate with inlet steam conditions of 725-lb. gage pressure and 700-deg. F. total temperature, which is said to represent the highest steam conditions of any industrial plant in the country.

The Grinnell Washing Machine Company, Grinnell, Iowa, has appointed R. R. Monroe, for the last five years secretary and auditor of the Detroit (Mich.) Street Railway Company, as vice-president. The company has been reorganized and will resume operations within a short time.

The L. J. Wing Manufacturing Company, 52 West Thirteenth Street, New York City, manufacturer of ventilating fans and exhausters, forced draft blowers and unit heaters, announces that it has purchased the factory property in Newark, N. J., which it has been occupying for the last five years and will immediately erect an extension to the present building, increasing its capacity about 50 per cent.

The Cook Porcelain Insulator Corporation, Cambridge, Ohio, manufacturer of porcelain insulators and power-line hardware, announces the establishment of a New York office at 161 Grand Street. J. H. Parker, formerly associated with the General Porcelain Company, is now located as Eastern sales representative there.

The Alloy Cast Steel Company, Marion, Ohio, has recently been organized by John D. Owens, C. A. Owens, M. C. McNeil, H. J. Barnhart, Frank D. Glosser, Walter A. Dorsey and E. J. Schoenlaub. The company has purchased the electric steel foundry of the Fairbanks Steam Shovel Company, which was recently sold at receiver's sale. The plant is now being completely overhauled and enlarged to a capacity of 400 tons of steel castings per month. The new company will manufacture high-grade electric steel castings in carbon, manganese and other alloy steel.

The Cecil R. Lambert Company, Inc., Detroit, specializing in the manufacture and installation of conveying and handling equipment, announces that, in order to identify its products and service with its name, the latter has been changed to the Mechanical Handling Systems, Inc. The company states that its facilities for service are being materially increased by additions to its plant and personnel, but there is no change in ownership, management or executive staff.

The Philadelphia Rust-Proof Company, Montgomery Avenue at Howard Street, Philadelphia, Pa., specializing in the protection of iron and steel products by the processes known as "parkerizing," the "udylite" process of cadmium coating and "sherardizing," has recently enlarged its plant.

The Electric Refrigeration Corporation, Buhl Building, Detroit, announces that the name of the Grand Rapids Refrigerator Company, Grand Rapids, Mich., since July 1, has been changed to the Leonard Refrigerator Company, division of the Electric Refrigeration Corporation. Announcement is also made of the election of Henry W. Burritt, formerly associated with the Ford interests, to the presidency of the Leonard Refrigerator Company.

The Appleton Electric Company, 1701 Wellington Avenue, Chicago, manufacturer of "Unilets" and other conduit fittings, has awarded a contract for the erection of a four-story and basement factory addition, which will cost about $200,000 with machinery and equipment.

New Equipment Available

Oil Burner

A self-protecting oil burner that uses only 1.3 per cent of steam, known as the "P & B" oil burner, has been placed on the market by F. Beers & Company, Federal Trust Building, Newark, N. J. The burner has only three parts, is of small size and is adaptable to any kind of flame to suit any type of furnace. It protects itself from overheating by absorbing the heat radiating through the cap into the steam used for atomizing. The design of the burner is such that it causes the steam to break up the oil into very minute particles. The breaking up is done inside, not outside of the burner. Four inside steam jets act at right angles to four oil jets.

Direct-Current Relays

A new line of direct-current relays which includes resistance measuring, over-current, voltage, polarized and relays of other types has been developed by the Westinghouse Electric & Manufacturing Company. This new "X" line closely resembles the Westinghouse induction-type alternating-current line and occupies about the same amount of switchboard space. The new relays operate on the magnetic-vane principle. Their operating values of current or voltage and their time of operation may be determined with a greater degree of accuracy than in the case of former types. They possess adjustable features so that the quantity operating them is adjustable, as well as their operating time, and they utilize a new form of contact which is easily aligned, or removed in its entirety for cleaning. The contacts are made of chemically pure silver as in other Westinghouse relays.

The resistance-measuring relay, type XM, has been developed for automatic service-restoring circuit breakers and actually measures the resistance of the feeder. It recloses the breaker when conditions indicate that the short circuit has cleared. A particular feature of the XM relay is its time limit, which prevents the breaker from pumping on recurring trouble.

Switch for Street-Lighting Service.—A new type of street-lighting service switch which is so small and compact that, if desired, it can be mounted inside of a street-lighting standard has been developed by the General Electric Company. The switch, designated as the CR2810-1384 Novalux switch, is a single-pole, double-break, solenoid-operated device and is rated 25 amp. at 110 volts on either alternating or direct current non-inductive circuits. It can be provided with either alternating or direct current operating coils. The new switch is available in three forms: No. 1384A with contacts normally closed, with the terminal board inside the cover, and with a weatherproof case; No. 1384B with contacts normally open, and otherwise the same as No. 1384A, and No. 1384C, with contacts normally closed, with terminal board exposed, and with non-weatherproof case. Power consumption is 10 watts on 60-cycle, alternating-current circuits and 8 watts on direct-current circuits.

New Trade Literature

DIESEL ENGINES.—The McIntosh & Seymour Corporation, Auburn, N. Y., has issued bulletin No. 90, covering the McIntosh & Seymour Diesel engines for central-station companies. Numerous illustrations are given showing typical installations of the Diesel engines in central-station plants and also one showing the first McIntosh & Seymour steam engine, built and installed in a sawmill forty years ago and which is still in active service. Line drawings for a steam-electric and a Diesel-electric plant contrast the layout and building requirements of a 1,500-kw. power plant with provision for adding 500 kw. more capacity at a future time.

HELICAL GEARS.—De Laval helical gears for relatively low ratios of speed transformation, either increasing or decreasing, are described in a leaflet issued by the De Laval Steam Turbine Company, Trenton, N. J.

CONTROL APPARATUS. — "Industry's Electrical Progress" is the title of a booklet issued by the Cutler-Hammer Manufacturing Company, Milwaukee. The booklet covers the electrical progress of industry and points out that the competitive advantages which electric power brings to industry lies in the effectiveness with which it is utilized. Many examples and photographs of actual installations show the accomplishments of correct motor-control equipment.

RELAYS.—The Roller-Smith Company, 233 Broadway, New York, has issued bulletin No. 550, describing its new line of type SR direct-current relays for reverse current, overload, underload, closed-circuit underload, overvoltage and undervoltage operations. Attention is also called to the company's type AB time-limit relays for use with alternating current or direct current.

ELECTRIC RANGES. — The Standard Electric Stove Company, Toledo, Ohio, has issued catalog 15, describing its line of Standard electric ranges. The catalog contains "The Story of Standard," as well as facts and figures covering Standard electric ranges. The company's serving tables, water heaters, fireless cookers, coffee urns, etc., are also described, and a list of accessories and repair parts is included.

FANS AND BLOWERS.—The American Blower Company, Detroit, has issued bulletin No. 7003 describing its type H. S. fans and blowers. The bulletin contains characteristic curves of the fan, specification sheets which describe and illustrate the various parts of a complete forced-draft blower, capacity tables based on tests run in accordance with the standard test code and dimension sheets in detail of all the standard arrangements.

PULVERIZED-FUEL EQUIPMENT.—Catalog U-2 describing the C-E unit system for burning pulverized fuel has been issued by the Combustion Engineering Corporation, Combustion Engineering Building, 43 Broad Street, New York. The construction and operation of the pulverizing mill used in the system is described and illustrated. Line diagrams of the applications of the C-E unit system to various types and sizes of boilers is included, and a chapter is devoted to furnace design. Attention is also called to the other products of the corporation.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Purchase and agency are desired in Barcelona, Spain (No. 21,225), for copper and aluminum wire.

A sole agency is desired in Yokohoma, Japan (No. 21,226), for boiler recorders and meters.

An agency is desired in Nantes, France (No. 21,207), for boiler and tube cleaners.

An agency is desired in Vienna, Austria (No. 21,205), for small and medium-priced refrigerating machines.

Purchase or agency is desired in Shanghai, China (No. 21,282), for floor polishers.

An agency is desired in Victoria, Brazil (No. 21,312), for household appliances.

An agency is desired in Liège, Belgium (No. 21,283), for household appliances, lighting fixtures, and wiring devices.

Purchase and agency are desired in Melbourne, Australia (No. 21,281), for lighting, heating, and ventilating systems.

Purchase is desired in Durango, Mexico (No. 21,318), of engines and pumps for waterworks.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

NEW HAVEN, CONN.—The Connecticut Company has filed plans for the proposed addition to its power plant at 450 Grand Avenue, to be 20 ft. x 104 ft.

SPRINGFIELD, MASS.—The Chapman Valve Manufacturing Company is planning to erect a new building for its electrical and maintenance departments, for which bids for building have been received. The equipment will include two transformers.

WORCESTER, MASS.—The J. W. Bishop Company, contractor, plans the installation of electric power equipment in connection with the proposed rebuilding of its woodworking plant recently destroyed by fire with a total loss reported at $175,000.

WESTERLY, R. I.—The Westerly Light & Power Company has plans for the construction of a three-story building, 50 ft. x 85 ft., for general operating service. Jackson, Robertson & Adams, Turks Head Building, Providence, R. I., are architects.

SOUTH BOSTON, MASS.—Bids will soon be asked by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for electric lighting and power system at the local naval dry dock.

BRATTLEBORO, VT.—The Connecticut River Power Company of New Hampshire plans the rebuilding of the portion of its Vernon power plant destroyed by fire, July 14, at a loss of approximately $30,000.

Middle Atlantic States

WILMINGTON, DEL. — The American Power Company has secured a permit for the construction of a one-story substation on Christiana Avenue, near Lobdell Street, 37 ft. x 88 ft., estimated to cost $17,000.

WASHINGTON, D. C.—A bill has been approved by congress for the construction of a steam-operated electric power plant, 80 x 150 ft. for the Bureau of Standards. The installation will include boilers, stokers, turbo-generator, condensers, pumps, coal-crushing and conveying machinery, feed-water heaters, mechanical draft apparatus, etc., with accessory equipment and instruments. It is estimated to cost close to $200,000.

BALTIMORE, MD.—The Consolidation Coal Company, Continental Building, plans the installation of electric power equipment and mining machinery at its Pinnickinnick mine, Clarksburg district.

BROOKLAWN, N. J. — The Borough Council is said to be considering the installation of pumping equipment in connection with a proposed municipal waterworks, estimated to cost $55,000.

ORANGE, N. J.—The City Commissioner is seeking an agreement with the Essex County Park Commission for extending the lighting of Park Avenue.

NEW YORK, N. Y.—The New York Edison Company has leased a block of property bounded by Forty-second and Forty-third Streets, First Avenue and the East River, and will establish a coal storage and handling plant. Equipment will be installed for unloading, conveying, etc.

NUNDA, N. Y. — The Nunda Electric Light Company has entered into a contract with the Mount Morris (N. Y.) Illuminating Company and the Genesee Valley Power Company, Fillmore, for the erection of a 132,000-volt transmission line from Mount Morris to Nunda. Contract for the line has been awarded to the Electric Shop, Mount Morris.

SYRACUSE, N. Y.—The Board of Contract and Supply, City Hall, has authorized plans for the construction of a central station for fire-alarm service in all parts of the city. Randall & Vedder, S. A. & K. Building, are architects. Nelson F. Pitts, City Hall, is city engineer.

UTICA, N. Y.—A 110,000-volt transmission line will be built in Deerfield Township to connect at Utica the system of the Niagara, Lockport & Ontario Power Company, the Northern New York Utilities and the Adirondack Power & Light Corporation. The last-named company has applied for authority to build the line, which will join the Utica-Ingham Mills line now connecting the lines of the Utica Gas & Electric Company and the Adirondack company near Little Falls. That line, now operated at 66,000 volts, will be reconstructed for 110,000 volts.

LAWRENCE, N. Y.—Bids will be received for the installation of street lights to be erected on Central Avenue. The cost is estimated at $6,000.

BROOKLYN, N. Y.—Plans and specifications are under way by the New York Quinine & Chemical Corporation for the construction of an addition to their present power plant. Thomas E. Murray, Inc., 55 Duane Street, are the engineers.

ALBANY, N. Y.—The Central Hudson Gas & Electric Company, Poughkeepsie, N. Y., has filed an application for approval of franchise rights for the construction of a high-tension transmission line through the towns of Chester and Warwick, Orange County, totaling 29 miles.

ALLENTOWN, PA. — Plans are being prepared by the Pennsylvania Power & Light Company for the construction of a twelve-story office building on Hamilton Street. Helmee & Corbett, 132 West Forty-second Street, New York City, are architects.

GROVE CITY, PA.—The Borough Council has tentative plans under advisement for the erection of a one-story addition to the municipal light and power plant, 35 ft. x 40 ft., with additional equipment. The expansion will cost about $45,000. Charles Foltz is borough engineer.

ANNVILLE, PA.—The Metropolitan Edison Company, Reading, recent purchaser of the Annville & Palmyra Electric Company, plans extensions in transmission lines in this section. The company will also make similar extensions in its transmission system at Bernville and vicinity.

HOLLSOPPLE, PA.—The Penn Public Service Corporation, Johnstown, plans extensions and improvements in transmission lines and system in this section.

McKEES ROCK, PA.—The Pressed Steel Car Company is installing two 1,300-hp. boilers with powdered fuel equipment, also a 3,000-kw. turbo-generator, and auxiliary equipment. Thomas E. Murray, Inc., 55 Duane Street, are the engineers.

MUNHALL, PA. — The Carnegie Steel Company, Pittsburgh, has made application for Federal permission, for the installation of a power transmission line across the Monongahela River, between Munhall and Rankin, comprising twelve 6,600-volt conductors and three ground wires.

North Central States

MATTOON, ILL.—The Mattoon, Ill., city council has disposed of its street-lighting system to the Central Illinois Public Service Company. The system will be revamped and modern equipment installed.

MURPHYSBORO, ILL. — The Western United Gas & Electric Company plans the early rebuilding of the portion of its local auxiliary power plant recently destroyed by fire with loss of about $17,000.

EVANSVILLE, IND. — The Chicago & Eastern Illinois Railroad Company, Chicago, plans the installation of electric power equipment in its proposed auxiliary locomotive and car repair shops in the Pigeon Creek section, reported to cost about $500,000, with machinery.

MONTPELIER, IND.—Plans are under way by the Indiana General Service Company, Muncie, to extend its transmission lines from Montpelier to Roll. Electricity will also be supplied to the farmers along the line.

NEW CASTLE, IND.—The City Council has awarded a contract for the installation of a pedestal lighting system in the business district to the Carter Electric Company, Kokomo, at $54,500. The plans call for 308 pedestals.

VINCENNES, IND. — Extensions have been authorized by the Interstate Public Service Company, Indianapolis, in the Vincennes district, to include the erection of a 2,300-volt line (6 miles long) from Spurgeon to Lynnville; from Merom to Graysville, 6 miles; taking over the Marco plant and installing a street-lighting system, and the erection of a high-tension line between Shoals and Loogootee.

MASON CITY, IOWA.—Plans are under way by the Peoples Gas & Electric Company for remodeling its local plant, at a cost of about $1,134,000. The work will include an addition to the power house, the installation of a 7,500-kw. turbine generator, two 750-hp. boilers, new coal conveying apparatus, etc.

MUSCATINE, IOWA.—The Iowa Electric Company of Cedar Rapids has requested permission to extend its power transmission line from Atalissa to Durant, a distance of 15 miles.

MINNEAPOLIS, KAN.—Plans have been made for the installation of an ornamental lighting system in the downtown district.

LOUISVILLE, KY.—The Kentucky Utilities Company, Louisville, has preliminary plans under way for the construction of a substation at Princeton, and extensions of transmission line to this section; also for one-story substations at Browder, Kuttawa, High Bridge and Barlo, and construction of transmission lines to these districts for light and power service. The entire project will cost in excess of $60,000.

CARSON CITY, MICH.—The Iosco Land Company has acquired the property of the Community Power Company. Plans are under advisement for extensions and improvements.

CHANNING, MICH.—The Chicago, Milwaukee & St. Paul Railroad Company, 80 East Jackson Boulevard, Chicago, Ill., plans the early construction of a power plant on local site, to be used in connection with the proposed locomotive terminal house and shop.

SOUTH HAVEN, MICH. — The Mount Pleasant Light & Power Company, South Haven, recently organized, plans the early construction of a transmission line in different portions of Allegan County.

BUTLER, MO.—The City Council has decided to extend the ornamental lighting system on all sides of the square.

GOLDEN CITY, MO.—The Ozark Utilities Company has been granted authority by the Missouri Public Service Commission to construct and operate an electric transmission line of 33,000 volts from Golden City, Barton County, to Jasper in Jasper County, with a three-phase, 2,300-volt transmission line to Kenona, Barton County and a 13,000-volt transmission line from Miller to Bowers Mill, connecting with La Russell, Stotts City and Sarcoxie.

NEOSHO, MO.—Work has started by the Electric Utilities Company, which recently acquired the electric systems of the Indian River Power Company, the Noel Mill & Power Company and the Electric Service Company, on the erection of a high-tension transmission line, from Neosho to Lanagan (20 miles long) which will connect all of these properties with the high-tension system of the Empire District Electric Company at Neosho. From Lanagan a 5-mile line will be erected to the Noel substation, and from there it will be extended to Southwest City. A new 800-hp. power station will be built at Lanagan and also at Neosho. The cost of the transmission line and improvements to the system is estimated at between $75,000 and $100,000.

SENECA, MO. — The Empire Electric Company, recent purchaser of the municipal electric power plant, is said to be planning extensions in transmission lines and other expansion in this district.

KIRKWOOD, MO.—Bonds to the amount of $200,000 have been approved for the improvement of the water system, the street lighting system and the electric power plant. $50,000 will be expended on improving electric facilities.

MARSTON, MO. — The Arkansas Missouri Power Company, Blytheville, Ark., plans extensions in its transmission system. The local power and light lines have recently been acquired. The company also contemplates extension in transmission lines in the vicinity of Potosi.

HAIGLER, NEB.—W. F. Woods plans the rebuilding of the portion of his electric lighting plant used for commercial service, recently destroyed by fire with a loss reported at $25,000.

SEWARD, NEB.—The Nebraska Gas & E'ectric Company is making a preliminary survey along the banks of the Missouri River east of Blair with the view of erecting a 33,000-volt line.

SIDNEY, NEB.—Stone & Webster, Inc., 147 Milk Street, Boston, is negotiating for the municipal electric plant. If taken over the company plans extensions to the plant, at a cost of $40,000, and to extend the line into Lodge Pole Valley to supply power for pumping water for irrigation purposes.

AVON LAKE, OHIO. — Appropriations for street lamps on the main roads of the village have been approved by the village officials.

COLUMBUS, OHIO.—The Arrow Sand & Gravel Company, Columbus, plans the installation of electric power equipment at its proposed plant on site lately acquired on West Mound Street, estimated to cost about $200,000, with machinery. W. H. Hoagland is treasurer.

DAYTON, OHIO.—Plans for rebuilding the mill and plant of the Appalachian Hardwood Lumber Company, at Pearl and Brookpark Streets, recently destroyed by fire include an electric power plant and the installation of electrically operated machinery.

FOND DU LAC, WIS.—The city has accepted the proposition of the Wisconsin Power & Light Company to replace the present arc-lighting system now in use at 150 street intersections.

KAUKAUNA, WIS. — The Kaukauna Municipal Electric & Water Department has adopted plans for the construction of 12 miles of distribution line to provide service to nearby rural communities.

MERCER, WIS.—The City Council has approved plans for the installation of an ornamental lighting system in the business section. Service will be furnished by the Lake Superior District Power Company, which will make extensions in transmission line.

EXELAND, WIS.—The North Electric Light & Power Company, Bellingham, Wash., has been granted a franchise for the construction of a power plant for local commercial service. The station will consist of a Diesel engine-driven generator and auxiliary equipment.

Southern States

ATHENS, ALA.—The City Council is considering the installation of a municipal electric light and power station, reported to cost about $25,000.

LAKE WORTH, FLA.—The City Council is considering the installation of an ornamental lighting system on a portion of H Street.

ORLANDO, FLA.—The Orlando Utilities, Inc., plans extensions and improvements in its electric generating plant to cost about $250,000, to include the installation of an additional generator, boilers and auxiliary equipment.

MIAMI, FLA.—The Florida Power & Light Company is arranging an expansion and improvement program to cost $1,500,000, including the construction of a new steam-operated electric power plant at Punta Gorda, with a capacity of 3,000 kw., to cost $500,000 with transmission lines and substation, installation of ice-manufacturing plants at Cocoa, Nocatee and other points, extensions and improvements in plant and system at Miami to cost $600,000.

ALBANY, GA.—The F. B. Harris Company is considering the construction of a one-story cold storage and refrigerating plant to cost about $25,000 with equipment.

ATHENS, GA.—The Georgia Railway & Power Company has authorized the construction of a transmission line from Commerce, about 14 miles, to operate at 22,000 volts.

DUBLIN, GA.—Electric power equipment will be installed in a proposed local mill, estimated to cost approximately $650,000, to be erected by the Southern Pulp and Naval Stores Company, Inc., for the manufacture of kraft pulp.

EATONTON, GA.—The Georgia Southern Power Company has been granted a franchise to operate in the town of Eatonton, and a high-tension line will be constructed by the company.

LYONS, GA. — The Georgia Southern Power Company, Dublin, plans extensions in transmission lines including substation installation. The company has recently taken over the local municipal light and power plant.

AUGUSTA, GA. — The Georgia-Carolina Electric Company, affiliated with the Augusta-Aiken Railway & Electric Corporation, contemplates extensions in transmission system in the Broad River district.

MARINGOUIN, LA.—The City Council has preliminary plans for extensions and improvements in the municipal electric lighting plant. F. P. Joseph, Glenmora, is engineer.

MONROE, LA.—The Brown Paper Mill Company plans the installation of an electric generating station in connection with its proposed mill expansion. The entire project will cost in excess of $1,000,000. George F. Hardy, 305 Broadway, New York, is consulting engineer.

PASCAGOULA, MISS.—The Mississippi Ice & Utilities Company is considering extensions and improvements in its ice-manufacturing plant, including the installation of additional equipment to cost $20,000.

SENATOBIA, MISS.—The City Council has preliminary plans under consideration for extensions and improvements in the municipal electric lighting plant. A bond issue will be arranged.

KING, N. C.—The Southern Public Utilities Company, Winston-Salem, N. C., plans the construction of a local substation for lighting service at a number of towns in this district.

WILMINGTON, N. C.—The Tidewater Power Company, Wilmington, has contracted with the City Council for the installation of an ornamental lighting system in the downtown section.

BURLINGTON, N. C. — Plans of the Southern Furniture Company for a new factory and office building, 100 ft. x 270 ft. in size, to cost $200,000, with machinery and equipment, include a one-story electric power plant and electrically operated woodworking machinery.

ELKIN, N. C. — The Southern Power Company will extend its line to furnish a power and light system.

ROCKY MOUNT, N. C.—The Carolina Power & Light Company, Raleigh, has completed plans for the immediate construction of a local substation. Work will also begin on the building of a transmission line from Zebulon.

SPARTANBURG, N. C.—The South Carolina Gas & Electric Company plans the early rebuilding of the portion of its local steam-operated electric power plant destroyed by fire, July 9, with loss reported at $150,000.

CANUTE, OKLA. — The Southwestern Light & Power Company, Lawton, has been granted a franchise to furnish electricity here. The company will install a local distribution system, which will be connected with its transmission system.

KINGFISHER, OKLA.—The City Council is planning the early purchase of equipment for installation at the municipal electric power plant for increased output. Work will be started at once on the building, to be one-story, 35 ft. x 46 ft. The expansion will cost about $50,000. Black & Veatch, Mutual Building, Kansas City, Mo., are engineers.

ALTUS, OKLA. — The Southwestern Power & Light Company plans the construction of a transmission line for local commercial service. A proposition has been made to the City Council for the purchase of the municipal electric light and power plant.

COLUMBIA, S. C.—The Broad River Power Company has acquired the Enoree Power Company, Enoree, S. C., with main generating station at Van Patton Shoals, S. C., and will consolidate with its organization. Plans are under way for extensions in the Enoree district, including transmission line construction.

CHATTANOOGA, TENN. — The Crane Enamelware Company will install electric power equipment in its proposed plant addition reported to cost about $450,000.

KINGSPORT, TENN.—A double circuit transmission line running from Switchback, W. Va., by way of Saltville, Va., is to be run into Kingsport. The lines will operate at 132,000 volts, and with a substation will cost about $1,000,000.

HARRIMAN, TENN. — The Tennessee Electric Power Company, Chattanooga, which has acquired the local electric plant, plans to extend its transmission line from Lenoir City to Harriman and thence to Oakdale.

McKENZIE, TENN. — The Kentucky-Tennessee Light & Power Company, Guthrie, Ky., plans extensions in transmission lines, including substation installation. The company recently took over the municipal electric power plant. Transmission lines will also be built in the vicinity of Murray, Ky.

AMARILLO, TEX.—The United Power & Light Company, Kansas City, Mo., has authorized the construction of a steam-operated electric power plant with initial capacity of 10,000 kw., for service in the Panhandle oil fields, estimated to cost in excess of $500,000. A number of transmission lines will be built.

CLARKSVILLE, TEX.—The Texas Public Utilities Company will proceed with an addition to the local substation that will more than double the present capacity. Distribution lines will be extended to New Boston, Avery, and vicinity for service from the local substation.

FORT WORTH, TEX.—The Magnolia Petroleum Company, Dallas, plans the installation of electric power equipment in connection with proposed extensions in its local refining plant, estimated to cost $500,000, with new machinery.

GALVESTON, TEX. — The Galveston Electric Company has tentative plans under consideration for extensions and improvements in its steam-operated electric power plant on Twenty-sixth Street, formerly the property of the Brush Electric Company, lately acquired, including the installation of additional equipment. The work is estimated to cost $180,000. R. G. Tabor is constructing engineer, in charge.

Pacific and Mountain States

BENSON, ARIZ.—The Cochise Utilities Company has preliminary plans for a proposed ice-manufacturing plant, to cost $25,000 with equipment.

LOS ANGELES, CAL.—Plans are being worked out by the Power Bureau to develop 47,000 additional horsepower in the city's Owens River hydro-electric plant and also for the erection of a high-voltage transmission system eventually to encircle the city. There will be two substations on this belt line, one at Central Avenue and Ninety-fifth Street and the other in the harbor district.

LOS ANGELES, CAL.—Plans are being considered for the installation of ornamental lamps on Beverly Glen Boulevard, Comstock, Pandora and Holmby Avenues and other streets, to cost about $50,000.

LOS ANGELES, CAL.—The Municipal Power & Light Bureau is arranging an expansion and improvements program to cost approximately $14,000,000, including the construction of a hydro-electric power plant in the Owens River district, with a capacity of 47,000 hp.; a steam-operated electric power plant in the San Pedro Harbor district for auxiliary service; extensions in transmission lines, substations and auxiliary work. E. F. Scattergood is chief electrical engineer.

SAN FRANCISCO, CAL.—The Feather River Power Company has been granted permission to use waters from Pebble Creek and branches of Milk Ranch Creek, Plumas County, to develop a capacity of close to 100,000 hp., estimated to cost $7,000,000, with transmission system.

SAN JACINTO, CAL.—The City Council has authorized the installation of an ornamental lighting system in the business district and will have specifications prepared at once, using concrete standards. The San Jacinto Improvement Association, T. W. Murray, secretary, is interested in the project.

JOHNSTOWN, COLO.—The Great Western Sugar Company, Sugar Building, Denver, contemplates the construction of a power plant at its proposed local beet sugar refinery. The entire project is reported to cost about $1,000,000.

MINIDOKA, IDAHO.—Bids will be asked at an early date by the United States Bureau of Reclamation, Denver, Colo., for a proposed hydro-electric generating unit and auxiliaries for the Minidoka power project. Plans have been forwarded to Washington, D. C., for approval. R. S. Walter is chief engineer at Denver.

SANTA FE, N. M.—The New Mexico Power Company contemplates extensions and improvements in the electric lighting plant and system of the Santa Fe Water & Light Company, recently acquired.

MILTON, ORE. — The Board of City Trustees is arranging an appropriation of $30,000, for extensions and improvements in the municipal electric light and power plant. Additional equipment will be installed.

SEATTLE, WASH. — The Metropolitan Building Company is considering a street-lighting installation covering an area bounded by Union and Seneca Street and Fourth and Fifth Avenues, to cost about $20,000.

TACOMA, WASH.—The City Council has adopted a resolution providing for the installation of an ornamental lighting system on a portion of South D Street.

Canada

POPLAR ISLAND, B. C.—Construction on the plant for the Canadian Rayon Pulp Company is expected to start within 60 days. The initial units will cost $1,000,000, which will comprise a 50-ton pulp mill, sawmill, and power plant.

MONTREAL, QUE.—Construction work is under way in connection with an addition to the plant at 198 St. Patrick Street, for the Northern Electric Company to cost $372,000. It manufactures electrical equipment, cables, wire, etc.

Electrical Patents

Announced by U. S. Patent Office

(Issued June 29, 1926)

1,590,599. METHOD OF MAKING INSULATED ELECTRICAL CONDUCTORS AND THE LIKE: E. Taylor, Brooklyn, N. Y. App. filed June 17, 1924. An electrical conductor with an improved insulation of organic material and a method of applying the same. May also be used for coating other objects than electrical conductors; for example, ribbons, sheets, etc., of various materials.

1,590,604. ELECTROLYTIC CELL; E. Taylor, Brooklyn, N. Y. App. filed June 21, 1924. For treatment of organic material such as a solution of cellulose in cuproammonia solution.

1,590,605. ELECTRIC BATTERY CONSTRUCTION; E. Taylor, Brooklyn, N. Y. App. filed June 21, 1924. Storage battery.

1,590,608. INSULATED ELECTRICAL CONDUCTOR AND THE LIKE; E. Taylor, Brooklyn, N. Y. App. filed March 11, 1920. With an improved insulation of organic material.

1,590,609. ELECTROLYTIC APPARATUS; E. Taylor and E. F. Chandler, Brooklyn, N. Y. App. filed Dec. 2, 1919. Wherein organic material such as celiulose in a fibrous or cellular condition may be converted by dissolving the cellulose in a suitable solvent.

1,590,715, 1,590,716, 1,590,717. BATTERY CELL; S. Aostoloff, New York, N. Y. Apps. filed Oct. 10, 1918, Nov. 28, 1919, and Dec. 2, 1919. Delayed action dry cell.

1,590,720. ANNUNCIATOR; O. Bennett, San Francisco, Cal. App. filed Dec. 22, 1922. For displaying at predetermined intervals of time announcements, as, for instance, names or numbers of streets as the same are approached by a moving car.

1,590,823. ELECTRIC CONNECTOR PLUG; F. W. Hewitt, Arlington, Mass. App. filed April 22, 1924. Such as is connected to a flexible electric conductor and used with appliances.

1,590,873. PRIMARY CELL; S. Apostoloff, Brooklyn, N. Y. App. filed June 10, 1921. Delayed action type.

1,590,896. SAFETY DEVICE FOR SEARCHLIGHTS; F. W. Linstadt, Los Angeles, Cal. App. filed March 15, 1923. Automatic cut-out for arc lights whereby burning of the electrode support is positively prevented.

1,590,930, 1,590,931. ULTRAVIOLET ELECTRODE; W. Falkenberg, New York, N. Y. App. filed June 6, 1923.

1,590,932. RADIATOR SUN; W. Falkenberg, New York, N. Y. App. filed June 6, 1923. Heater with means for making it useful for medical purposes.

1,590,952. TIME-LIMIT INDUCTION RELAY; W. H. Petersen, Gamla Posten, Ludvika, Sweden. App. filed Jan. 11, 1923.

1,590,954. ELECTRICAL TAP SOCKET; J. Precious, Providence, R. I. App. filed Dec. 15, 1923.

1,590,959. LIGHTING FIXTURE; R. W. Schweiker, Lansdale, Pa. App. filed May 2, 1925. Means for fastening electric sockets to side-wall fixtures.

1,590,962. BATTERY GRID AND METHOD OF MAKING THE SAME; L. G. Stecker, Philadelphia, Pa. App. filed Dec. 13, 1923.

1,590,970. APPARATUS FOR MEASURING ELECTRIC CURRENTS; J. Fritz, Dresden-Strehlen, Germany. App. filed Feb. 9, 1924. Comprising a high-tension line, a current indicator a transformer core associated with the high-tension line and a conductor connected at its ends to the high-tension line passing around the transformer core and with which conductor the current indicator is connected.

(Issued July 6, 1926)

1,591,029. FUSE INDICATOR; F. A. Feldkamp, Newark, N. J. App. filed June 15, 1922. Detachable indicator device for cartridge fuses which may be readily attached to indicate visually when the fuse is blown.

1,591,112. STARTING APPARATUS FOR VAPOR LAMPS; L. J. Buttolph, East Orange, N. J. App. filed Nov. 14, 1923. For high-voltage fused-quartz lamps.

1,591,113. METHOD AND APPARATUS FOR ELECTRIC WELDING; L. J. Buttolph, East Orange, N. J. App. filed Aug. 30, 1924. Method for welding parts with different cross-section or of the same cross-section in which detrimental heating effects are eliminated.

1,591,128. ARC-LIGHT PROJECTOR; P. L. Haynes, Hoboken, N. J. App. filed May 4, 1923. Suitable for moving-picture studio work.

1,591,163. METHOD AND APPARATUS FOR PREVENTING EXPLOSIONS IN ELECTRICAL APPARATUS; T. T. Greenwood, East Templeton, Mass. App. filed April 29, 1924. Such as oil circuit breakers. A method and apparatus for maintaining so great a proportion of the gases and vapors of the arc-quenching or insulating fluid with air that the mixture cannot explode.

1,591,185. ARC RECTIFIER; E. H. Rollinson, Lyons Farms, N. J. App. filed April 16, 1921. Means for uniformly heating the cathode of the rectifier bulb so as to avoid excessively hot spots or sections in the filament.

1,591,186. PHASE-ANGLE INDICATOR; E. M. Russell, Saginaw, Mich. App. filed June 7, 1922.

1,591,305. ELECTRIC PAD OR BLANKET; N. E. Goodrich, Battle Creek, Mich. App. filed Jan. 26, 1925.

1,591,338. LAMP SOCKET; R. D. Smith, Scarsdale, N. Y. App. filed March 15, 1922. Means for converting an ordinary fixture socket into a candle fixture.

1,591,415. ELECTRICAL REVERSIBLE MECHANISM; W. W. Brown, Oak Lane, Pa. App. filed Dec. 10, 1924. For motors in various applications of machine drive, which may, by a simple adjustment, be set to operate the motor continuously in one direction or another, or automatically to reverse it at predetermined intervals.

1,591,434. SYSTEM OF MOTOR CONTROL; D. C. Prince, Schenectady, N. Y. App. filed July 23, 1925. For automatically maintaining a predetermined relation between the speeds of a plurality of separate driving motors.

1,591,435. POLYPHASE INDUCTION MOTOR; P. Rohde, Waismannslust, Germany. App. filed April 28, 1923. Two stator windings are arranged side by side and cooperate with two squirrel-cage windings on the same shaft.

1,591,449. ELECTRICAL TRANSFORMER; C. M. Welch, Ogden, Ark. App. filed Oct. 24, 1921. Distributing transformer of light weight, accessible terminals, positive support for the core and coils to prevent mechanical strain on the insulation during transportation, which can be shipped full of oil, uses no cast iron in its construction and has no tap connections or loose parts within the case.

1,591,457. STARTING SWITCH FOR ELECTRIC MOTORS; G. S. Leddick, Schenectady, N. Y. App. filed Oct. 8, 1924. Having a plurality of positions and a single operating means, together with a latching mechanism, whereby movement of the operating means in one direction moves the starting switch to one operating position and a reverse movement of the operating mechanism will permit the starting switch to assume another operating position. For alternating-current motors.

1,591,468. HEATING APPARATUS; W. L. Clouse, Tiffin, Ohio. App. filed Sept. 1, 1923. For heating long bars or rods of iron or steel, such as are used, for example, in the manufacture of bolts, rivets, nuts, springs and the like.

1,591,692. ELECTRIC BRAKE; C. N. Alter and E. Smith, Alliance, Ohio. App. filed April 3, 1925. Such as are employed on bridge hoists and similar apparatus; normally spring-applied and adapted to be moved to the released position by a relatively small amount of applied power.

1,591,707. ATTACHMENT FOR PLUG RECEPTACLES; W. H. Harrington, Hartford, Conn. App. filed Sept. 8, 1922.

1,591,747. COMBINED TEMPERATURE REGULATOR AND CIRCUIT BREAKER FOR IRONS; J. A. Delmarquem Winnipeg, Manitoba, Canada. App. filed Sept. 1, 1923. With means for automatically controlling the temperature and to adjust such means to keep the iron at any desired temperature.

1,591,772, 1,591,773. ATTACHMENT PLUG RECEPTACLE; A. H. Nero, New Britain, Conn. App. filed June 9, 1921.

1,591,791. ADJUSTABLE LAMP BRACKET; C. H. Sprout, Philadelphia, Pa. App. filed Sept. 1, 1922.

1,591,856. FIRE-ALARM DEVICE; C. H. Matter, Newport, R. I. App. filed April 23, 1924. Circuit closer.

1,591,867. COVER OR CASING FOR JOINTS IN ELECTRIC CABLES; J. F. Watson, Abbey Wood, England. App. filed Nov. 24, 1924. For inclosing straight-through joints in high-tension and extra-high-tension cables.